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# A REVISION OF SIX SUBFAMILIES OF ATHERINE FISHES, WITH DESCRIPTIONS OF NEW GENERA AND SPECIES

By Leonard P. Schultz

Among the fishes that I collected in 1942 in the Lago de Maracaibo Basin of Venezuela I found some aberrant silversides that were attracted to a light at night. In an endeavor to place these in the proper genus, I began a study of the American genera of silversides, using as a basis the 1919 review of the group by Jordan and Hubbs[1] and more recent papers by Dr. Hubbs. Soon it became apparent that an enormous amount of work still needed to be done on these fishes, especially on osteology, in order to clarify the status and relationships of the various genera of Atherinidae and that it would be necessary to include in my study all the genera of silversides, starting with the genotypes of each genus. Jordan and Hubbs' revision has served a most useful purpose for many years, but as new material became available for study it was inevitable that new characters would be discovered and new conclusions reached. I have found particularly that some of the genera said by them to be related are not closely related. Study of the significance of the extension of the air bladder into the haemal arches of the caudal vertebrae, neglected by most previous ichthyologists, has helped to clarify the picture in this family.

This study includes all the atherine fishes commonly known as silversides except the subfamilies Melanotaeniinae, Bedotiinae, and Rheoclinae. These subfamilies, which were recognized by Jordan and

[1] Jordan, David Starr, and Hubbs, Carl Leavitt, Studies in ichthyology: A monographic review of the family Atherinidae or silversides. Leland Stanford Junior Univ. Publ., Univ. Ser. [No. 40], 87 pp., 12 pls., 1919.

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Hubbs, are distinguished by having nonpungent dorsal spines or first dorsal fin elongate, reaching the second, whereas the ones treated herein have pungent spines in first dorsal fin not reaching the second. The genus *Nannatherina* Regan, included in the silversides by Jordan and Hubbs, has been placed by Regan in the family Kuhlidae.

Although the phallostethid fishes have much in common with the atherinids, especially in fin structure, mouth parts, air bladder, and other features, on the basis of the present known differences I am of the opinion that the two families are distinct from each other, the Phallostethidae ranking among the Mugilidae, Atherinidae, Sphyraenidae, and possibly the Polynemidae. Among other characters, the specialization of the copulatory organs separates the Phallostethidae, which may be considered viviparous silversides.

The conclusions herein presented were made after several hundred lots of silversides, containing a few thousand specimens from most parts of the world, were examined. Despite this abundant material, most of which is in the United States National Museum, I have had difficulty in assigning the species to genera of concise definition, mainly because of the great complexity of the numerous kinds of silversides whose characters in many instances overlap. Inadequate descriptions in the literature have been very troublesome, especially in regard to genera that have been based entirely on external characters. No attempt is made to place under each genus all the species belonging there, since to do so would require the reexamination of the types scattered in museums around the world. The range of each genus as given in the key may be extended as various species are more thoroughly studied and referred to the genera herein characterized.

The classification that follows summarizes the subfamilies and genera treated in this paper. The arrangement of the subfamilies indicates relationships. The specialized condition of the air bladder and first few haemal arches may have evolved separately in the various subfamilies.

Family ATHERINIDAE
- Subfamily ATHERININAE
  - Genus *Atherina* Linnaeus
  - Genus *Hepsetia* Bonaparte
  - Genus *Atherinason* Whitley
- TAENIOMEMBRASINAE, new subfamily
  - Genus *Taeniomembras* Ogilby
  - Genus *Craterocephalus* McCulloch
  - *Stenatherina*, new genus
  - Genus *Alepidomus* Hubbs
  - Genus *Allanetta* Whitley
  - *Hypoatherina*, new genus
  - Genus *Pranesus* Whitley
  - Genus *Atherinomorus* Fowler

ATHERIONINAE, new subfamily
- Genus *Atherion* Jordan and Starks

TROPIDOSTETHINAE, new subfamily
- Genus *Notocheirus* Clark
- Genus *Tropidostethus* Ogilby
- Genus *Iso* Jordan and Starks

MENIDIINAE, new subfamily
- Genus *Melanorhinus* Metzelaar
- Genus *Archomenidia* Jordan and Hubbs
- Genus *Xenatherina* Regan
- Genus *Labidesthes* Cope
- Genus *Atherinella* Steindachner
- Genus *Thyrinops* Hubbs
- Genus *Melaniris* Meek
- Genus *Chirostoma* Swainson
- Genus *Menidia* Bonaparte
- Genus *Poblana* de Buen
- *Menidiella*, new genus
- *Xenomelaniris*, new genus
- *Adenops*, new genus
- Genus *Membras* Bonaparte
- Genus *Eurystole* Jordan
- Genus *Nectarges* Myers and Wade
- Genus *Coleotropis* Myers and Wade
- Genus *Hubbesia* Jordan

Subfamily ATHERINOPSINAE
- Genus *Austromenidia* Hubbs
- Genus *Leuresthes* Jordan and Gilbert
- Genus *Odontesthes* Evermann and Kendall
- Genus *Hubbsiella* Breder
- Genus *Basilichthys* Girard
- Genus *Atherinopsis* Girard
- Genus *Atherinops* Steindachner

In glancing over the various genera referable to the subfamilies recognized in this revision, their distribution appears to be characteristic.

The subfamily Atherininae contains three genera occurring in the European region, the Mediterranean and Caspian Seas and possibly in nearby groups of islands, and the southern Australian region. I have had no material from the Canary Islands or from the coastal regions of Africa, where it may occur.

The subfamily Taeniomembrasinae contains eight known genera both salt and fresh water, mostly of tropical and subtropical distribution. They are found in Australia, the Central and Western Pacific and Indian Oceans, Japan, Atlantic Ocean from Africa to Bermuda, and the Western Atlantic from Florida, West Indian region, to Brazil. The fresh-water species of this subfamily occur in Cuba and in the Australian region.

The subfamily Tropidostethinae contains marine species in three known genera, all of which have been found occurring in the surf, from

Japan, India, Australia, Tasmania, the south and east coasts of South Africa, and Chile. Its range should be materially extended as more collecting is done in the ocean surf. Perhaps from an ancestral stock, represented by the Atherioninae, with the monotypic genus *Atherion*, the Tropidostethinae could have evolved. Both appear to prefer surf or near-surf conditions.

In the Menidiinae I have recognized 18 genera, fresh-water and marine, all of which are American. It too is a New World subfamily, ranging on the Atlantic side from Nova Scotia to Brazil and on the Pacific side from Mexico to Peru and the Galápagos Islands. The Menidiinae contain 18 genera with the most variable characters in any subfamily of the silversides, and these characters overlap somewhat among a few closely related genera. There are eight genera found only on the Atlantic side and seven on the Pacific. Three genera, *Melanorhinus*, *Thyrinops*, and *Coleotropis*, have species on both sides of Central America. Many of the genera in this family are peculiar to certain stream systems of the New World.

The Atherinopsinae are a New World subfamily containing seven known genera, six of which are confined to the Pacific coastal region ranging from Oregon to Mexico and from Peru to Patagonia. The other genus, *Odontesthes*, occurs from Argentina to Brazil. Both fresh-water and marine species are found in this American subfamily. So far none of the genera have been collected on the Atlantic or Pacific sides of Central America. Four genera occur from Oregon to Baja California and the Gulf of California, and the other three genera occur from Peru to Patagonia, the Falkland Islands northward to Brazil. As far as known, the subfamily is not tropical, occurring in the temperate and subtropical regions.

The New World forms the sole habitat of 28 genera of silversides and shares 1 additional genus, *Allanetta*, with the tropical Western Pacific and Indian Oceans and the tropical Atlantic Ocean. There remain 11 genera occurring in the Old World. Nine of these are found in the Western Pacific and Indian Oceans, leaving two for Europe and Asia Minor.

My key to the genera, though somewhat artificial in itself, is practical and defines the natural generic units as observed by me. Unfortunately, those who classify and base genera mostly on external characters will find this family a little too complex. Ichthyological studies must be increasingly more carefully done if the various genera are to be thoroughly understood. Though it is necessary to use certain internal structures, this method need not be too complex for practical purposes.

The premaxillary may be pulled forward to expose the nature of the ascending processes, and the tissues should be dissected off to expose

the sides and posterior end. The elevated processes or rami at the rear end of the mandibles are usually visible without dissection. The teeth must be examined by means of a microscope, since the old-time hand lens is of little use for the study of minute details and can be discarded as far as atherinids are concerned.

The length of the head is from the tip of the snout to its posterior fleshy edge; in counting the vertebrae I have used, for example, the formula 14+18, the 14 representing the abdominal and the 18 the caudal vertebrae. The first caudal vertebra is the one that gives rise to the first haemal arch, and this arises on the posterior part of the vertebra, thence extending ventrally under the next vertebra. In certain genera in the Atherinopsinae, where the haemal arch appears to form at about six or seven vertebrae in front of the enlarged hypophyses, I have counted as the first caudal vertebra the one bearing the first enlarged or broadened hypophysis. This appears to bring the counts for such genera as *Atherinops* and *Leuresthes* into line with the other genera. Scales were counted from the upper edge of the gill opening to the midbase of the caudal fin. In the fin-ray formula I use capital Roman numerals for spines, lower-case Roman numerals for unbranched soft rays, and Arabic characters for the branched soft rays; for example, IV–I, i, 10, the dash indicating that the first dorsal fin is separated from the second dorsal fin. In determining whether the lower jaw projects beyond the tip of the premaxillaries, I considered that it did if it extended beyond a vertical line through tip of snout. The maxillary was considered to extend past front of eye when its posterior tip was behind a vertical line through front of eye.

## KEY TO GENERA OF ATHERINIDAE

*1a.* Head truncate posteriorly; pectorals placed high on body, upper part of base above silvery lateral band, if present (absent in *Melanorhinus*); body sharply compressed; anterior edge of premaxillary a little concave; anus located closer to anal origin than to base of pelvics, scarcely in an advanced position; rami of mandibles elevated; body cavity ending abruptly and not extending into haemal arches.

*2a.* Midventral line from in front of anal origin to between pelvic fins with a fleshy keel nearly of paper thinness; head with fine to coarse denticles anteriorly and ventrally; premaxillaries not protractile and not dilated posteriorly; ascending premaxillary process short and broad; silvery lateral band present; greatest depth of body equal to or more than length of head; vertebrae in two counts 14 to 18+25 to 28__(subfamily TROPIDOSTETHINAE)

*3a.* Anterior as well as rest of body fully scaled; ventral keel scaled; spiny dorsal fin absent; pectorals almost entirely above silvery lateral band; front of head with conspicuous denticles; scales with denticles; dorsal rays about 17; anal about I, 29 (Valparaiso Harbor, Chile).

Notocheirus Clark

*3b.* Anterior part of body and head naked; ventral keel naked except for scales around anus; spiny dorsal present, small; pectoral bases about

as much above the silvery band as below it; front of head with small denticles; scales without denticles.

4*a*. Silvery lateral band fading and interrupted or narrowly constricted on caudal peduncle, then continuing and expanding, ending in a prominently enlarged silvery area (southern Australia, Tasmania, South Africa, and India)________________Tropidostethus Ogilby

4*b*. Silvery lateral band continuous and not interrupted (Japan). Iso Jordan and Starks

2*b*. Midventral line of abdomen without a fleshy keel as above although ventral edge is sharply compressed and fully scaled; head without denticles; premaxillaries protractile and expanded posteriorly; ascending process a narrow-based slender bony spinelike projection; silvery lateral band absent; greatest depth of body more than length of head; pelvic insertion notably closer to upper angle of pectoral fin base than to anal origin; axillary scale of pelvics exceedingly long, usually about two-thirds of eye; both dorsal and anal fins with a sheath of scales one row wide; origin of first dorsal far in advance of anus, nearly over tips of pelvics; anus just in front of anal origin; vertebrae in two counts 14+22 and 14+24 (Atlantic and Pacific sides of Central America and in Cuba and West Indies) (subfamily MENIDIINAE)________Melanorhinus Metzelaar

1*b*. Head not truncate posteriorly; pectoral not placed above silvery lateral band or notably high on body, usually opposite or below silvery lateral band; silvery lateral band normally present; midventral line of abdomen without fleshy keel, although ventral edge may be sharply compressed and scaled; head usually without denticles but if present in nearly parallel lines (*Atherion*); premaxillaries protractile or not protractile.

5*a*. Edge of premaxillary either straight or a little convex, gape of mouth not concave and posterior end of premaxillary not notably broadened or dilated; rictus scarcely restricted at corner of mouth by a membrane folding between jaws; anus notably in advance of anal origin; anal-fin origin always far behind first dorsal origin; pelvic fins inserted notably closer to pectoral base than anal origin; ascending premaxillary process meeting its fellow along midline, at least basally; teeth in villiform bands, sometimes reflected on outer face of premaxillary as "shagreen."

6*a*. Air bladder or body cavity tapering to a point posteriorly, and extending into three to six of the haemal arches, which have more or less broadened hypophyses opposite the air bladder (figs. 1*b* and 1*c*); no denticles or spinules; one or two short lateral processes on premaxillary in addition to ascending terminal one; origin of first dorsal closer to tip of snout than to caudal fin base; scales if present on base of pectoral small, not enlarged; rami of mandible elevated (see pls. 1, 2). (subfamily ATHERININAE)

7*a*. Air bladder extending into five or six of the broadened haemal arches, the latter not connecting by a bony platelike process with the following arch; anus behind tips of pelvics, closer to anal origin than to pelvic bases.

8*a*. Anterior ascending premaxillary process long and slender, reaching past front of orbits; vomer and palatines without teeth; middorsal ridge obvious just behind rear of head (southern European region) ____________________________________Atherina Linnaeus

8*b*. Anterior ascending premaxillary process broad, not reaching past front of orbit; vomer and palatines with obvious but small teeth; no middorsal ridge behind head (southern European region). Hepsetia Bonaparte

7*b*. Air bladder extending opposite three of the broadened haemal spines and connecting with next haemal arch by a bony platelike process; anus in front of tips of pelvic fins, much closer to pelvic bases than to anal origin; anterior ascending premaxillary process long and slender reaching past front of orbits; teeth on vomer present or absent; middorsal ridge scarcely evident behind head; maxillary reaching past front of eye; scales small about 70 to 75; posterior margin of scales angular or somewhat pointed (southern Australian region)------------------------------Atherinason Whitley

6*b*. Air bladder or body cavity ending bluntly just in front of anal origin, not entering first haemal arch; none of haemal spines or hypophyses broadened (fig. 1*a*)------------(TAENIOMEMBRASINAE, new subfamily)

9*a*. Gill rakers tuberculate, fewer than 12 on lower part of first arch; premaxillary process moderately long, about equal to or a little longer than diameter of pupil; mouth small, maxillaries notably not reaching to a vertical line through front of orbits; teeth at front of both jaws somewhat enlarged, conical, those on premaxillary in one row and on dentary in two irregular rows; lips at corner of mouth fused about one-third the way toward tip of premaxillary; anus in front of tips of pelvic fins---------------Craterocephalus McCulloch

9*b*. Gill rakers long to moderately long, slender, not tuberculate, more than 12 on lower limb of first gill arch.

10*a*. Ascending premaxillary process long, slender, notably longer than diameter of pupil, equal or nearly equal to diameter of eye, reaching considerably into interorbital space, a shorter process or spinelike projection on side of premaxillary (fig. 2*b*); rami of mandibles elevated; premaxillary dentition not reflected as shagreen on outer face of this bone; soft rays of dorsal, anal, and pectoral fins without scaly sheath; teeth in both jaws in a narrow villiform band; maxillary reaching or nearly reaching a vertical line through front of orbit; first dorsal origin about equidistant or a little closer to tip of snout than to midbase of caudal fin; scales on opercle and on pectoral base greatly enlarged; one row of scales below eye; teeth on vomer; anus behind tips of pelvic fins----------------------------------Stenatherina, new genus

10*b*. Ascending premaxillary process short, broad based, about equal to or shorter than pupil, not notably extending into interorbital space.

11*a*. No scales on shoulder girdle below pectoral base; opercular scales probably absent; no concavity on bony edges of preopercle; no sheath of scales along base of anal fin and no scales on bases of dorsal or pectoral fins; posteriorly the rami of mandibles inside mouth not elevated; lower jaw a trifle longer than upper; distal margins of soft dorsal and anal fins notably concave; vertebrae in one count 15+21 (fresh waters of Cuba)-----------------------------------Alepidomus Hubbs

11*b*. Scales present and greatly enlarged on shoulder girdle below pectoral base; opercular scales greatly enlarged.

12*a*. Posteriorly the rami of mandibles are distinctly elevated (figs. 3*c* and 3*f*).

13*a*. Posterior margin of anterior bony edge of preopercle truncate, without concavity, a short but distinct lateral process on premaxillary; anus between pelvics (Australian region). Taeniomembras Ogilby

13*b*. Posterior margin of anterior bony edge of preopercle with a concavity near its lower corner.

14*a*. Anus in front of tips of pelvic fins, usually in front of first dorsal origin (central tropical Pacific westward to Africa and tropical western Atlantic) __ **Allanetta Whitley**

14*b*. Anus behind tips of pelvic fins and under base of spiny dorsal fin (central tropical Pacific westward to Africa). **Hypoatherina, new genus**

12*b*. Rami of mandibles not elevated (figs. 3*d* and 3*e*).

15*a*. Bases of dorsal, anal, and pectoral fins naked (central and western Pacific and Australian region) ___ **Pranesus Whitley**

15*b*. Bases of dorsal, anal, and pectoral fin rays with scales (western Atlantic from Florida to Brazil). **Atherinomorus Fowler**

5*b*. Edge of premaxillary concave or gape of mouth concave and premaxillaries notably dilated or broadened posteriorly (figs. 4*a–e*); rictus more or less restricted at rear corner or side of mouth by a membrane folding between jaws; anus usually close in front of anal origin or far in advance of it in *Archomenidia* and *Adenops;* anal fin origin behind or in front of first dorsal fin origin; pelvics usually inserted a little closer to anal origin than to upper edge of pectoral base except in *Adenops* and *Atherion;* ascending premaxillary processes of two types: If spinelike, not meeting its fellow along midline except at tips; if short and broad-based, meeting along midline.

16*a*. Spinules in more or less parallel rows on head and especially on under side and in front of eye; premaxillary and dentary with shagreen-like denticles covering their outer surfaces; air bladder and body cavity ending bluntly in front of anal origin and not extending into haemal arches; anus just in front of anal fin origin, scarcely advanced in position; first dorsal origin a little in front of a vertical line through anus and slightly closer to tip of snout than to caudal fin base; mouth small, maxillary not reaching orbit; rami of mandibles strongly elevated; ascending premaxillary process a short, broad, truncate, platelike projection, no lateral processes on premaxillary (fig. 2*g*); vertebrae 16 or 17+24 or 25; vomer with minute teeth, palatines probably edentulous (Japan to Marshall Islands southward to Lord Howe Island) (subfamily ATHERIONINAE) _____ **Atherion Jordan and Starks**

16*b*. No spinules on head in rows; teeth in rows, conical, enlarged and canine-like or in villiform bands but never reflected on outer surface of premaxillary or on dentary as "shagreen."

17*a*. Air bladder tapering to a point posteriorly and extending into five or more of haemal arches and five or more of first caudal vertebrae with broadened hypophyses, these broadened hypophyses mostly interconnecting with one another by flattish posteriorly projecting bony processes, opposite tapering posterior part of air bladder; vertebrae in increased number ranging from about 24 to 33+18 to 30 ______________________________ (subfamily ATHERINOPSINAE)

18*a*. Premaxillary protractile, not bound firmly to tip of snout by a frenum; ascending bony process of premaxillary with narrow base, not triangular in shape, and more or less separated at anterior midline by a cartilaginous or fleshy rod (figs. 4*a*, 4*d*); margins of scales rough or entire.

19*a*. Scales small in more than 68 rows from upper edge of gill opening to midbase or caudal fin; scaly sheath at base of anal present or absent; more than 15 rows of scales between dorsal origins; either no teeth on vomer or a very few minute ones that can be felt with a needle or seen under magnification.

20*a*. Origin of first dorsal far in advance of anal origin and in front of a vertical line through anus; no scaly sheath along base of anal fin or at least not more than a few scales at anal origin; base of last ray of second dorsal over, a little behind, or a little in front of base of last anal ray; posterior margin of scales entire or slightly crenulate; teeth in jaws in outer row a little enlarged, inner row of minute teeth single or in a narrow irregular band; sometimes a few scales at anterior part of interorbital space are reversed in imbrication; vertebrae in four counts 24 to 28+23 to 30 (Peru to Patagonia, Juan Fernández and Falkland Islands along coast and in fresh waters)______________________Austromenidia Hubbs

20*b*. Origin of first dorsal a little behind origin of anal fin; a well-developed scaly sheath along base of anal fin; base of last ray of second dorsal notably in advance of base of last anal ray or over about fifth from last anal ray; posterior margin of scales strongly crenulate; teeth minute, microscopic, or lacking, if present in a narrow villiform band; no scale in interorbital space reversed in imbrication; vertebrae in two counts 29+20 to 22 (San Francisco Bay to Baja California)_____________________Leuresthes Jordan and Gilbert

19*b*. Scales larger in fewer than 60 rows from upper edge of gill opening to midbase of caudal fin; origin of first dorsal between a vertical line through anal origin and one through anus; sheath of scales along anal base confined to a small group at anterior part of base of that fin; 7 to 9 rows of scales between dorsal origins; base of last ray of second dorsal behind base of last anal ray; about 25 to 30 gill rakers on lower limb of first gill arch.

21*a*. Teeth in both jaws enlarged, rows rather widely spaced but sometimes irregular; teeth on vomer more or less well developed, obsolete in young; snout more or less pointed, somewhat pikelike in *perugiae;* premaxillaries moderately protractile; margins of scales entire; dorsal rays IV–I, i, 7 to VII–I, i, 10; anal rays I, i, 13 to 16; vertebrae in two counts 26 or 27+22 to 23 (Atlantic coasts from Brazil to Argentina in fresh waters)______________Odontesthes Evermann and Kendall

21*b*. Teeth minute in about two rows on jaws; possibly minute teeth on vomer, but none on palatines; snout not pointed; premaxillaries excessively protractile as in *Leuresthes tenuis;* margins of scales rough or entire; dorsal rays VI–I, i, 8; anal I, i, 21; scales 54 to 56; vertebrae in one count 29+20 (Gulf of California)___________________Hubbsiella Breder

18*b*. Premaxillary not protractile, connected to tip of snout by a frenum; ascending premaxillary process a short broad-based triangular plate, not spinelike; posterior margin of scales entire; origin of first dorsal over anus or a little in advance of a vertical line through anus.

22*a*. Scales on dorsal surface of head reversed in imbrication as far posteriorly as a line connecting across rear of orbits; base of last ray of dorsal a little behind base of last anal ray; scales small, in very numerous rows; a small patch of teeth at head of vomer sometimes present; teeth in jaws in a band, outer row slightly enlarged; vertebrae in two counts 26 to 29+21 (Peru and Chile in streams and probably in salt waters).
Basilichthys Girard

22*b*. Scales, if present, on dorsal surface of head not reversed in imbrication, but normal; base of last ray of second dorsal about over base of first to third from last anal rays.

23*a*. Teeth conical-pointed, in two or three rows on jaws; first dorsal of VII to IX spines; snout somewhat pointed, jaws about equal; vertebrae in one count 33+18 (California to Baja California in salt water)__________Atherinopsis Girard

23*b*. Teeth with bifid tips, in a single row on jaws; first dorsal of IV to VII spines; tip of snout broadly rounded, extending a little in front of upper lip, so that tip of snout is a little anterior to bifid teeth; vertebrae in one count 28+20 (coasts from Oregon to Baja California and offshore islands; also Gulf of California)______Atherinops Steindachner

17*b*. Air bladder not tapering to a point posteriorly and not extending into five or more of the haemal arches, the latter not modified as above [sometimes extent of body cavity may be observed by placing fish in front of a very bright light]; vertebrae about 13 to 23+18 to 27____________________________(subfamily MENIDIINAE)

24*a*. Posterior end of body cavity extending to opposite anal origin or well past anal-fin origin; air bladder not extending past second haemal arch.

25*a*. Anus far in advance of anal-fin origin, as close to or closer to pelvic bases than to anal origin; scales not lacking on head or on body; a sheath of scales, anteriorly at least, along base of anal fin; first dorsal origin over or slightly in advance of anal origin; pelvic insertions equidistant between anal origin and upper angle of pectoral fin base; maxillary not quite extending to a vertical line through anterior margin of eye; teeth of outer series stronger and more regular than inner series; when mouth is closed outer premaxillary teeth somewhat exposed and directed outward; dorsal and anal fins falcate; vertebrae in one count 22+18; ascending process of premaxillary a short, broad-based triangular plate, meeting along midline; no glandularlike depressions on dorsal surface of snout; axillary scale of pelvic fins well developed; margins of scales entire or slightly scalloped; scales 40 to 42; dorsal rays IV or V—I, i, 8 or 9; anal rays I, i, 16 to 18 (east-coast streams of central Mexico).
Archomenidia Jordan and Hubbs

25*b*. Anus usually just in front of anal-fin origin, always closer to anal origin than to pelvic fin bases.

26*a*. Scales lacking on head, on shoulder girdle in front of pectoral fin base, and on anterior part of body, except a few rows may extend forward a little between the naked areas; ascending premaxillary process a broad-based triangular

plate; no scaly sheath along anal base; first dorsal origin behind a vertical line through anal-fin origin, about over base of third branched anal ray; pelvic insertions a little closer to anal origin than to upper angle of pectoral base; maxillary reaching to under eye, nearly or quite to below front of pupil; base of last ray of second dorsal a trifle behind base of last anal ray; teeth in an irregular narrow band with some a little enlarged and a few somewhat pointing forward along outer face at front of premaxillary; vertebrae in one count 16+23; body somewhat compressed ventrally (east-coast streams of Veracruz, Mexico).

Xenatherina Regan

26*b*. Scales normally present on anterior part of head and body or, if there is a tendency for scales to be lacking on head and in front of base of pectoral fin, ascending premaxillary processes spinelike and not broad-based triangular plates.

27*a*. Jaws produced into an angular beak; lower jaw a little longer than upper or equal to it, with exposed part of premaxillary at front of snout long, equaling two-thirds interorbital space; ascending premaxillary process a broad-based triangular plate (fig. 4*b*); anus closer to anal origin than to pelvic base; origin of first dorsal a little behind anal origin; teeth conical, in two rows anteriorly, one row along sides; no sheath of scales along anal fin base; base of last ray of second dorsal over base of fourth from last anal ray; margin of scales entire; anus just in front of anal origin; vertebrae in one count 20+21 (fresh waters of eastern North America northward to southern Michigan and Lake Ontario).

Labidesthes Cope

27*b*. Upper jaw rounded, not beaklike, or if upper jaw is angular and somewhat pointed, lower jaw projecting; ascending premaxillary process a narrow-based, bony, spinelike projection or a broad-based triangular plate; anus located just in front of anal origin or much closer to anal origin than to pelvic insertions.

28*a*. Origin of first dorsal fin notably behind anal origin, at least over or behind base of second branched anal-fin ray; belly sharply compressed or somewhat rounded.

29*a*. Origin of first dorsal fin over middle of length of anal-fin base; belly sharply compressed, carinate; pectoral fins about one and a half length of head; posterior margins of scales dentate; two rows of scales below eye; no scaly sheath along base of anal fin (west coast of Panama)_________Atherinella Steindachner

29*b*. Origin of first dorsal fin over front of anal-fin base, notably in front of middle of length of anal-fin base, but over or behind base of second branched anal ray; belly compressed or rounded, not carinate.

30*a*. Ascending premaxillary process a narrow-based spinelike projection, not triangular; lower jaw included or nearly equal; belly somewhat compressed; a sheath of scales along anal-fin base for its entire

length or sometimes only a few scales anteriorly (in poorly preserved specimens sealy anal sheath may be lacking); four glandlike depressions on top of snout, sometimes indistinct in poorly preserved specimens and represented by pores in *T. colombiensis;* scales with posterior margins dentate, weakly crenate (except in the young the scale margins entire, or in adults of certain species margins entire except for a row or so of crenulate scales along middorsal line); teeth in outer row a little enlarged, then a narrow band of villiform teeth inside; vertebrae in several counts 18 to 20 + 19 to 22 (marine, west coast of Mexico to Panama Bay and in fresh waters of Mexico to Central America; also Atlantic side of Guatemala to Panama in streams). Thyrinops Hubbs

30*b*. Ascending premaxillary process short, broad-based, and triangular in shape; lower jaw equal to or a trifle longer than upper jaw, not included; belly rounded; no sheath of scales along anal-fin base; no glandlike structures on snout as in 30*a*; margins of scales entire; teeth in outer row somewhat enlarged, conical, followed by a widely spaced inner row on lower jaw, but on upper jaw inner teeth irregular or in a narrow villiform band; vertebrae in two counts 15 or 16 + 22 or 23 (Río Balsas, Guerrero, west coast of Mexico) ---------Melaniris Meek

28*b*. Origin of first dorsal notably in front of anal origin to over base of first branched ray of anal fin; belly rounded.

31*a*. Lower jaw usually angular, somewhat pointed at tip, longer than upper, notably projecting in front of tip of snout when mouth is closed; front tip of premaxillaries angular, more or less pointed; body cavity extending notably past anal origin, at least beyond base of third branched anal ray; margins of scales entire or crenulate; no scaly sheath along base of anal fin; ascending bony process of premaxillaries usually narrow-based and elongate or spinelike, with a V-shaped space between them; teeth in both jaws in two or three irregular rows, conical, sometimes enlarged; vertebrae in several counts 19 to 23 + 18 to 24 (fresh waters of Río Lerma Basin and Valley of Mexico). Chirostoma Swainson

31*b*. Lower jaw a little longer than upper or a little shorter or included, not angular but with rounded tip; front tips of premaxillaries rounded; body cavity extending to opposite anal-fin origin or to base of fifth branched anal ray in *Menidia extensa;* margins of scales entire or very weakly crenulate.

32*a*. Lower jaw equal to or slightly longer than upper jaw; ascending premaxillary process a narrow-based spinelike projection; posterior margin of premaxillary bone convex or rounded; origin of first dorsal

fin in advance of anal-fin origin; pelvic axillary scale, if present, very small, not over two-thirds diameter of pupil.

33*a*. Postorbital length of head contained more than twice in length of anal-fin base; scales normally formed on anterior part of body and in front of pectoral-fin base; teeth of outer and inner rows about of equal size, a little enlarged; vertebrae 17 to 21+19 to 27; no scaly sheath along base of anal fin; greatest depth of body 4½ to 7 times in standard length; soft rays of anal fin 13 to 28 (Nova Scotia to mouth of Rio Grande, Tex., in fresh and salt waters) ________ Menidia Bonaparte

33*b*. Postorbital length of head contained 1 to 1⅔ times in length of anal-fin base; teeth minute in a narrow band in both jaws; greatest depth of body 2⁹⁄₁₀ to 5½ times in standard length.

34*a*. Scales lacking in front of base of pectoral fin and irregularly lacking on head and on front part of body; vertebrae in one count 16+22; no scales along base of anal fin; soft rays of anal fin 13 to 16 (fresh water, Laguna de Alchichica, Puebla, Mexico) _____________ Poblana de Buen

34*b*. Scales normally formed on head, body, and in front of base of pectoral fin; vertebrae in one count 14+18; two or three scales at front of anal-fin base forming a rudimentary sheath anteriorly; soft rays of anal fin 9 to 14 (Key West, Fla., and Yucatán) ____ Menidiella, new genus

32*b*. Lower jaw included, a little shorter than upper jaw; ascending premaxillary process moderately broad-based but forming an elongate triangular platelike projection, usually longer than pupil; posterior margin of premaxillary angular (fig. 4*c*); origin of first dorsal fin over or nearly over anal origin, sometimes over base of first branched anal-fin ray; axillary scale of pelvic fin three-fourths diameter of eye; vertebrae in three counts 17 or 18+20 to 23; teeth in outer row of upper jaw enlarged, consisting of 6 to 10 widely spaced ones at front of jaw, within this outer row a narrow band of villiform teeth; teeth of lower jaw similar but more numerous than in outer row (Venezuela to Brazil, in fresh, brackish, and salt waters) ______ Xenomelaniris, new genus

24*b*. Air bladder or posterior end of body cavity notably not reaching anal-fin origin.

35*a*. Dorsal surface of snout with four shallow glandlike depressions; anus far in advance of anal-fin origin; origin of first dorsal fin over anal origin or in front of it; ascending premaxillary process a narrow-based, elongate, spinelike projection (fig. 4*e*); a scaly sheath present, at least anteriorly along anal-fin base;

axillary scale of pelvics present; teeth minute in a narrow villiform band on both jaws; mouth small, maxillary not reaching to opposite orbit; scale margins entire or crenulate.

36*a*. Vertebrae usually 14 to 16+22 to 26; anus in middle third of length between anal origin and pelvic bases or closer to pelvic bases than anal origin, at tips of pelvic fin rays or in front of their tips; origin or first dorsal notably in advance of a vertical line through anal origin; pelvic insertions about equidistant between anal origin and upper angle of pectoral fin base (Lago de Maracaibo, and Colombia on Atlantic side) ________________ Adenops, new genus

36*b*. Vertebrae usually 18 to 20+23 to 25; anus in front of anal origin a distance of about one-fourth the way to pelvic bases, notably behind tips of pelvic rays; origin of first dorsal over anal origin or a trifle in advance of it; pelvic insertions closer to anal origin than upper angle of pectoral fin base (New York to Florida and Gulf coast of Mexico and West Indies). Membras Bonaparte

35*b*. Dorsal surface of snout without four glandlike depressions; anus more than three times closer to anal origin than to pelvic-fin bases, usually just in front of anal-fin origin; pelvic insertions midway between anal origin and some point on pectoral-fin base or closer to anal origin.

37*a*. Vertebrae 13 or 14+24 to 27 (based on three counts); posterior margins of scales entire; belly somewhat compressed; ascending premaxillary process a broad-based, short, triangular-shaped platelike bony projection; anal-fin origin much closer to middle of length of head than to caudal-fin base; scaly sheath present at least anteriorly along base of anal fin.

38*a*. Origin of first dorsal fin slightly behind or over anal-fin origin; teeth in a narrow band on jaws in two or three rows.

39*a*. Anal fin with 3 to 8 small scales in a single row along anterior base of anal fin; silvery lateral band constricted to a line on caudal peduncle and broadening again into a triangle at caudal base; scales in a lateral series from upper end of gill opening to hypural fan 38 to 40; predorsal scales 13 to 16; scales around caudal peduncle 12; maxillary reaching vertical of a point about midway between anterior border of orbit and anterior border of pupil when mouth is tightly closed; vertebrae in one count 13+24 (Gulf of California to Peru) ________________ Eurystole Jordan

39*b*. Anal-fin base with a wide scaly sheath of two rows in width along most or all of its length; silvery lateral band scarcely or only very slightly constricted on caudal peduncle, never constricted to a thin line; scales in lateral series 58 to 65; predorsal scales 23 to 28; scales around caudal peduncle 16 to 18; maxillary not or barely reaching vertical of front edge of orbit when mouth is tightly closed; vertebrae in one count 14+26 (Gulf of California to Peru and Galápagos Islands). Nectarges Myers and Wade

38*b*. Origin of first dorsal over bases of fourth or fifth branched rays of anal fin; teeth pointed, a little enlarged, in two rows on jaws; anal-fin base with a wide scaly sheath composed of two rows of scales along its entire length; silvery lateral band somewhat constricted on caudal peduncle, bordered above with a dark line; scales 39 to 40 from upper edge of gill opening to midbase of caudal fin; predorsal scales about 18; scales around caudal peduncle 12 to 16; maxillary reaching to below front part of eye; vertebrae in one count 14+27 (Pacific side of Panama and Atlantic from Gulf of Venezuela to Brazil). Coleotropis Myers and Wade

37*b*. Vertebrae 18 to 21+25 or 26 (based on three counts); posterior margins of scales crenulate; belly rounded or slightly compressed; ascending premaxillary process a narrow-based spinelike projection; anal-fin origin much closer to caudal-fin base than to rear edge of head; no scaly sheath along base of anal fin; silvery lateral band somewhat constricted on caudal peduncle; origin of first dorsal fin in front of anal origin, nearly over anus; base of dorsal without scaly sheath (Pacific, from Gulf of California to Panama)------------------------------Hubbesia Jordan

## Subfamily ATHERININAE

This subfamily as previously understood by authors must be further restricted in the light of information evolved in the present study. This restriction should have been made by Jordan and Hubbs in their review, especially since Clementina Borsieri furnished such beautiful illustrations of the modified vertebrae and premaxillaries in the Annali di Agricoltura 1902, No. 233, pls. 6–10, 1904, to which they refer. Parts of these plates are herein reproduced (pls. 1, 2).

The subfamily Atherininae, as here restricted, includes those silversides with the posterior part of the premaxillary not dilated or notably broadened, that have the air bladder tapering to a point posteriorly and entering about three to six of the haemal arches, the latter with broadened hypophyses. Species referable to this group of which I have examined specimens came from the coasts of France, Italy, Greece, and the Caspian Sea and southern Australia. Undoubtedly the subfamily is not confined to the Mediterranean and Caspian Basins, and the southern Australian region and its range should be extended as species not available to me are studied. I do not know whether this type of silversides occurs in the Red Sea. There is no evidence of any kind that the Atherininae as here restricted occur in American waters as I have examined the vertebral column in all the American species of silversides heretofore referred to that subfamily.

In view of the similarity of the ascending premaxillary processes in the various species referable to this subfamily, it may be shown on

fresh material that the tooth characters used in my key are of no significance. In that case *Hepsetia* will be relegated to the synonymy of *Atherina*. However, since *Atherina hepsetus* shows extreme development of the ascending premaxillary process, I am tentatively recognizing *Atherina* as distinct from *Hepsetia*.

The first attempt to break up the all inclusive genus of *Atherina* Linnaeus was that of Bonaparte in *Iconografia della fauna italica*, volume 3, Pesci, in which he states:[2]

ATHERINA HEPSETUS

We shall divide the *Atherinides* into three classes, calling them *Atherina*, *Membras* and *Menidia*. The germ of this classification is to be found in the great work on fishes, continued by Prof. Valenciennes alone, and embodying the materials which he gathered under the guidance of his immortal teacher.

The first of these classes (*Atherina*) is characterized by the dorsal forefin being placed above the ventral ones and by the fact that [the fish's] mouth, cleft as far back as directly under the eye, is supplied with teeth, although exceedingly small, even on the palate.

The second class is distinguished by the fact that the first dorsal fin is placed above the anal one; the fish's mouth is obliquely cleft as far as the eye, the palate is toothless.

The third class, beyond having the dorsal forefin placed far back, is eminently distinguished by the fact of having a more horizontal mouth, cleft only down to the middle of the snout. All these features, jointly with the smallness of the eye, result in a different physiognomy. The palate is smooth and toothless.

The larger species clearly present a very singular characteristic trait which, in reality, brings them in proximity to the mullets, which are the only fishes possessing such a trait. The bones constituting the jaw are extremely slim; the back section of the maxillary bone, instead of becoming broader close to the angle of juncture, ends in a thin point.

Leaving aside the genera *Membras* and *Menidia*, formed exclusively of exotic species, we shall restrict ourselves to the *Atherina*, a cosmopolitan genus, in which all the Italian species are included. These genuine Atherinae may also, should we wish to be rigorous, be subdivided into two subgenera, which, by restoring the nomenclature established by Rondelez, we shall call *Hepsetia* and *Atherina;* forasmuch as (as the above-mentioned Valenciennes remarks) some species, among which we may instance the only European one, i. e., *Atherina boyeri* (*Hepsetus*, according to Rondelez, possess visible teeth both on their jaws and on their vomer and palatine bones; their head is broad and flat, their eyes large, their first dorsal fin small and corresponding to the terminal tip of the ventral fins; whereas other species, as in particular our *Atherina hepsetus* with a more pointed snout (*Atherina*, in Rondelez's nomenclature), possesses such small teeth as to be almost inconspicuous; their dorsal forefin is rather large and corresponding to the center of the pectoral fins. It does not, however, seem necessary to establish two subgenera for such species which can hardly be discerned by the keen zoologist's eye; nor could one absolutely separate them, except for the fact that the forms of our proposed *Hepsetia* are to be found, in exaggerated proportions, in foreign types. Nevertheless, we are exhibiting in a globe four species of Italian Atherinae which are the only ones whose existence

[2] Translation by Dr. Elio Granturco, research assistant, Foreign Law Section, Library of Congress, to whom I extend my sincere thanks for this courtesy.

we have been able to ascertain, being unable to admit the existence of other species purely on the word of other scientists. Common to all four [species], nay, to all the known species of that genus, as we have delimited it, are the following characteristics.

Thus there can be no doubt that Bonaparte retained the genus *Atherina* and restricted it to European species. He definitely indicates that *Atherina hepsetus* is the species on which he based his diagnosis of the genus *Atherina.* This is in conformity with *Atherina* Linnaeus, with the genotype—*Atherina hepsetus* Linnaeus.

There is left the genus *Hepsetia* Bonaparte, and again the genotype is definitely indicated as *Atherina boyeri.*

I have carefully studied several lots, including numerous specimens of both species, *A. hepsetus* and *A. boyeri*, from the Bonaparte collection in the National Museum and find that the two species are in the same phyletic line.

There remain, after excluding *Atherina* and *Hepsetia*, a large number of generic names proposed for species of silversides previously under the catch-all genus *Atherina.* Among these I fail to find a single species in which the air bladder enters the haemal arches as in the subfamily Atherininae. All of them have the air bladder and body cavity similar to the drawing as shown in figure 1*a*.

The first genus named that belongs to this latter group is *Taeniomembras* Ogilby, 1898, with the genotype *Atherina microstoma* Günther from the Australian region, and these genera all belong to another subfamily, herein recognized as the Taeniomembrasinae, new subfamily.

The above discussion is not in full agreement with Dr. Jordan's note in Copeia, No. 32, pp. 47–48, 1916, entitled "On *Hepsetia* Bonaparte, a Forgotten Genus of Atherinoid Fishes." *Membras* is not a synonym of *Atherina.*

### Genus ATHERINA Linnaeus

Plates 1, 2; Figures 1*c*, 2*f*

*Atherina* Linnaeus, Systema naturae, ed. 10, p. 315, 1758 (genotype: *Atherina hepsetus* Linnaeus). (Internat. Comm. Zool. Nomenclature 1922, opinion No. 75.)

*Aphia* Risso, Histoire naturelle des principales productions de l'Europe méridionale . . ., vol. 3, p. 287, 1826 (genotype: *Aphia meridionalis* Risso). The species described is not in sufficient detail to know with certainty if it should be referred to *Hepsetia* or *Atherina*, but it probably belongs as a synonym of *Atherina.*

Borsieri recognized five species from the Mediterranean region, but I refer only *Atherina hepsetus* with certainty to this genus. Probably *Atherina presbyter* Cuvier and Valenciennes belongs in this genus too.

The generic diagnosis is based on several specimens of *A. hepsetus* in the National Museum.

### Genus HEPSETIA Bonaparte

PLATES 1, 2; FIGURES 1*b*, 2*a*, 2*c*, 3*a*, 3*g*

*Hepsetia* BONAPARTE, Iconografia della fauna italica . . ., vol. 3, Pesci, fasc. 91, 1836 (genotype: *Atherina boyeri* Risso).

Among the five species recognized by Borsieri I refer *Atherina boyeri* Risso, *A. mochon* Cuvier and Valenciennes, and *A. rissoi* Cuvier and Valenciennes to this genus.

The generic diagnosis is based on several specimens of *A. boyeri* in the National Museum.

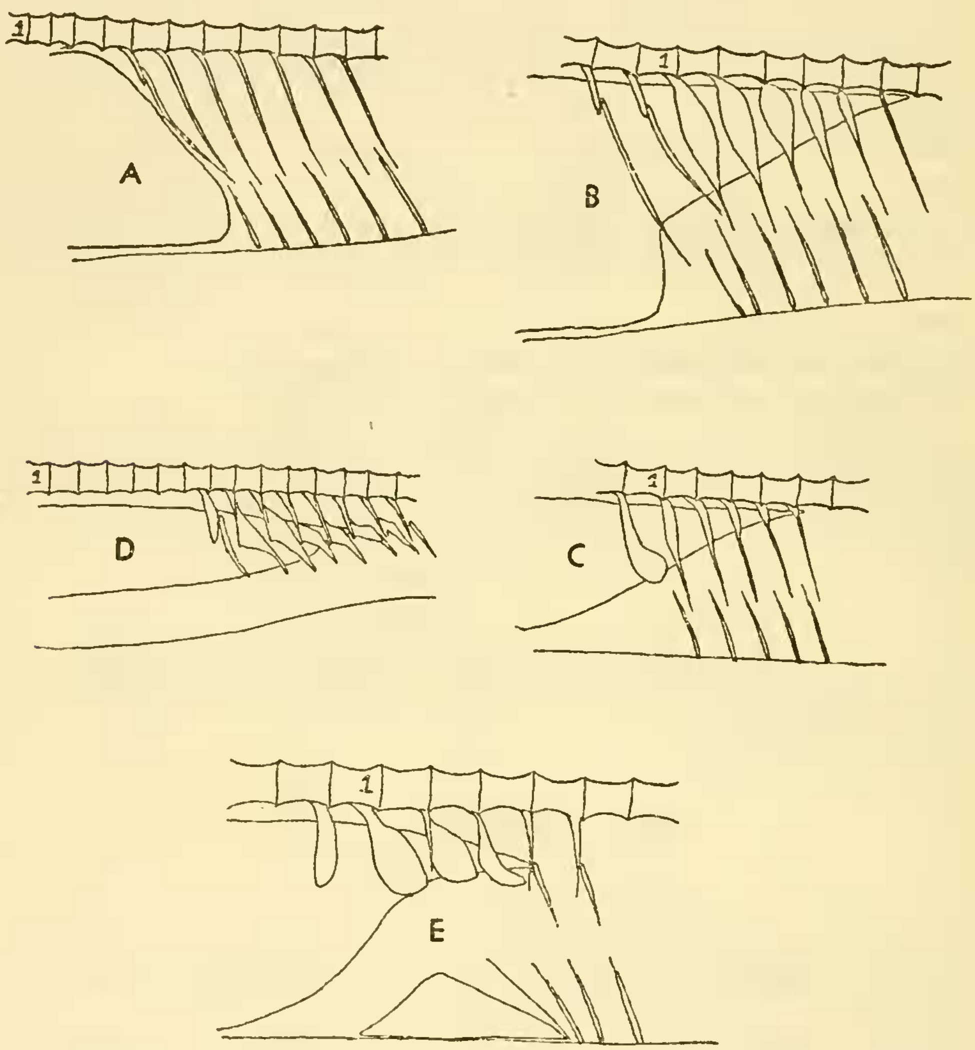


FIGURE 1.—Diagrammatic sketches of the posterior end of the body cavities of certain species of Atherinidae, showing the posterior end of the air bladder and the bones forming the haemal arches: *A*, *Stenatherina temminckii* (Bleeker), based on U.S.N.M. No. 136763 from the Philippines; *B*, *Hepsetia rissoi* (Cuvier and Valenciennes), based on U.S.N.M. Nos. 10088 and 121859 from Europe, Bonaparte collection; *C*, *Atherina hepsetus* Linnaeus, based on U.S.N.M. No. 10157 and 45503 from the Mediterranean, Bonaparte collection; *D*, *Atherinops affinis* (Ayres), based on U.S.N.M. No. 125271 from California; *E*, *Atherinason dannevigi* (McCulloch), from specimens from Port Hacking, New South Wales, and from Kangaroo Island, southern Australia, sent by Dr. Ian S. R. Munro.

### Genus ATHERINASON Whitley

FIGURE 1e

*Atherinason* WHITLEY, Victorian Nat., vol. 50, No. 10, p. 241, 1934 (genotype: *Atherina dannevigi* McCulloch, Zool. Results *Endeavour*, vol. 1, pt. 1, p. 31, pl. 16, fig. 2, 1911).

This genus is monotypic and comes from Spencers Gulf, South Australia, and Oyster Bay, Tasmania. I have studied several specimens and the diagnosis is based on them and the descriptions by McCulloch. In four counts the first dorsal was VIII, the second dorsal I, i, 9 in one, I, i, 10 in three, and the anal was I, i, 11 in four.

## TAENIOMEMBRASINAE, new subfamily

Now that the Atherininae are restricted to the European silversides and one Australian genus that have the air bladder tapering to a point posteriorly and entering three to six haemal arches with broadened hypophyses, there remains a group of genera, previously referred to the Atherininae, that are without a subfamily name. This is easily remedied by assigning the new name Taeniomembrasinae to that group of genera with straight or convex anterior edges of premaxillaries, whose posterior tips are not broadened or dilated, and the air bladder and vertebrae are not modified as above. Thus restricted this subfamily includes a variety of genera in the Atlantic and Pacific Oceans, and probably westward across the Indian Ocean to the east Coast of Africa, although I have not examined any specimens from the Indian Ocean.

Although Hubbs (Occ. Pap. Mus. Zool. Univ. Michigan, No. 488, pp. 1–10, 1944) discusses recent generic divisions of the all-inclusive genus *Atherina* Linnaeus and proposes a new one, *Alepidomus*, his treatment of this group did not reveal the distinctive nature of the vertebrae and air bladder in the genera *Atherina*, *Hepsetia*, and *Atherinason*. Gilbert P. Whitley, in his generous naming of new genera, apparently relied largely on hunches rather than on careful diagnosis, leaving to later ichthyologists the complicated task of making the comparisons that should have been made when the new genera were proposed. My comments and generic diagnoses are based on materials in the National Museum or on specimens examined through loan or exchanges. It is sincerely hoped that this treatment is a step forward in working out the generic limits of this complex subfamily.

Since I do not have specimens available of all the species of silversides described and belonging to this subfamily, I shall leave the assignment of the various species to the proper genus until the types can be examined by those ichthyologists working in the museums where the material is preserved.

### Genus TAENIOMEMBRAS Ogilby

*Taeniomembras* OGILBY, Proc. Linn. Soc. New South Wales, vol. 23, p. 241, 1898 (genotype: *Atherina microstoma* Günther).
*Pranesella* WHITLEY, Victorian Nat., vol. 50, No. 10, p. 241, 1934 (genotype: *P. endorae* Whitley).

Jordan and Hubbs' reference (1919, p. 42) to specimens of *A. microstoma* from Victoria indicates that the rami of the mandibles are elevated and the mouth scarcely smaller than several other species of the genus. This appears to agree with two specimens from the South Australian Museum sent to me by the director, Herbert M. Hale, to whom I express my sincere thanks for his cooperation. The two specimens (now U. S. N. M. No. 123274) are from Port Willunga, Australia, and were identified as *Atherina microstoma* by E. R. Waite. The rami of the mandibles are somewhat elevated; the maxillary reaches to a vertical line at front of eye; there are a few minute teeth on the vomer but none on the palatines; and the air bladder ends abruptly and in front of the anal origin. From these two specimens the generic description was made.

I am referring *Pranesella endorae* Whitley to this genus on the basis of his 1934 description.

### Genus CRATEROCEPHALUS McCulloch

*Craterocephalus* McCULLOCH, Proc. Roy. Soc. Queensland, vol. 24, p. 48, pl. 1, fig. 1, 1912 (genotype: *C. fluviatilis* McCulloch).

The diagnosis of this genus in the key is based on the original description of the new genus and new species by McCulloch, cited above, and on eight specimens of *Craterocephalus stercusmuscarum* kindly sent to me by Dr. Ian S. R. Munro. These were taken in the Barrow River, Kuranda, North Queensland.

Other species belonging to this genus are *C. nouhuysi* (Weber), *C. lacustris* Trewavas, *C. randi* Nichols and Raven, and *C. annator* Whitley.

### STENATHERINA, new genus

FIGURES 1*a*, 2*b*, 3*b*

*Genotype.*—*Atherina temminckii* Bleeker=*A. brachyptera* Bleeker.

This new genus differs from all other genera in the subfamily Taeniomembrasinae by having the ascending premaxillary process at front of snout long, slender, and extending past front of orbits into the interorbital space, with a second process or spinelike projection laterally on the premaxillary. Other important differences are diagnosed in my key. *Stenatherina* is characterized by its slender, fusiform body; the air bladder ending bluntly and abruptly a little in front of the anal-fin origin; the rami of mandible somewhat elevated; the gill

rakers long and slender; ascending premaxillary process long, slender, spinelike, reaching far into the interorbital space; lips fused at rear corner of mouth about one-fourth their lengths; anus far in advance of anal origin; maxillary reaching to under front of eye.

McCulloch and Waite (Rec. South Australian Mus., vol. 1, No. 1, p. 41, 1918) redescribed *Taeniomembras tamarensis* (Johnson, Proc. Roy. Soc. Tasmania, 1882 [1883], p. 122, and 1890 [1891], p. 34). These descriptions and 12 specimens taken at Schouten Island, and another lot of six from Oyster Bay, both Tasmania, were sent to me

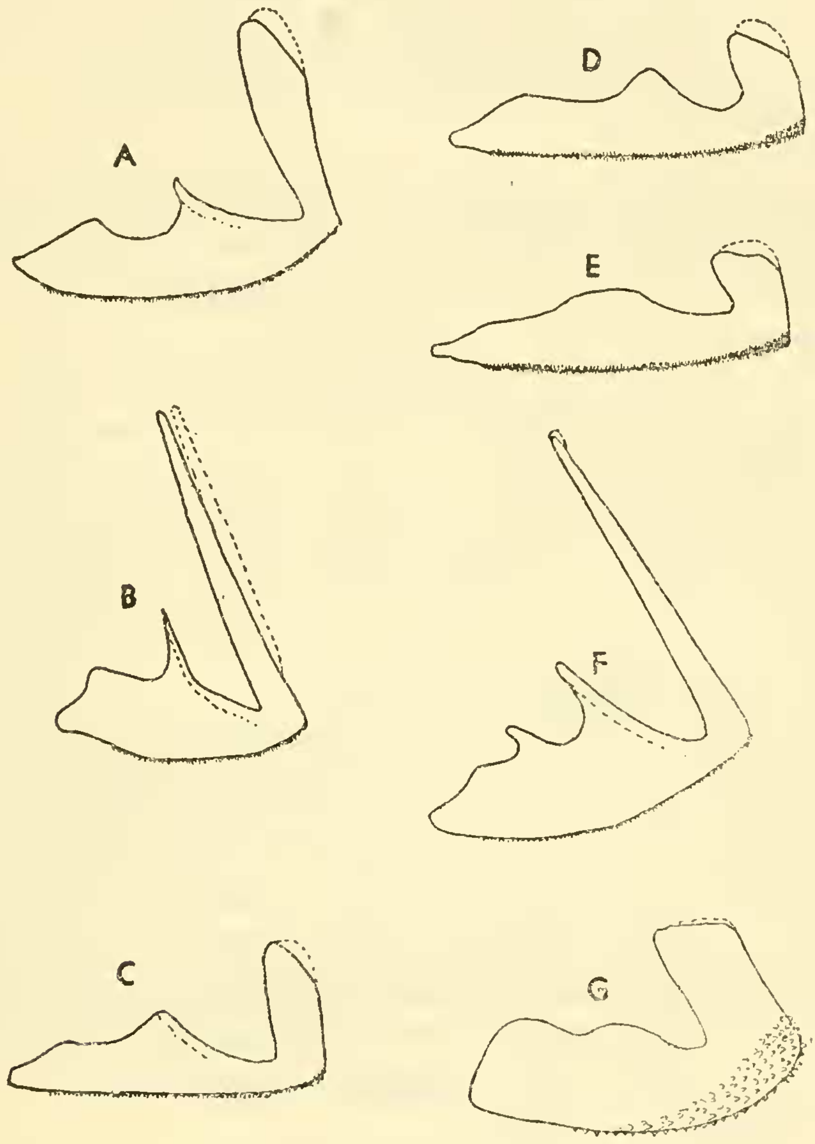


FIGURE 2.—Diagrammatic sketches of the premaxillaries of certain species of Atherinidae: *A*, *Hepsetia rissoi* (Cuvier and Valenciennes), based on U.S.N.M. Nos. 10088 and 121859 from Europe, Bonaparte collection; *B*, *Stenatherina temminckii* (Bleeker), based on U.S.N.M. No. 136763 from the Philippines; *C*, *Hepsetia boyeri* (Risso), based on U.S.N.M. Nos. 2942 and 48366 from Europe, Bonaparte collection; *D*, *Allanetta area* (Jordan and Gilbert), based on U.S.N.M. No. 89597 from Cuba; *E*, *Pranesus insularum* (Jordan and Evermann), based on U.S.N.M. No. 51169 from Hawaii; *F*, *Atherina hepsetus* Linnaeus, based on U.S.N.M. Nos. 10157, 45535, and 48365 from Europe; *G*, *Atherion elymus* Jordan and Starks, based on U.S.N.M. No. 49812, paratypes from Japan.

by Dr. Ian S. R. Munro. They have been useful in the diagnosis of this genus. Two vertebral counts were 21+26 and 21+26.

Dr. Munro sent me two other lots of atherinids that I have identified as *Stenatherina honoriae* (Ogilby). Seven specimens came from the lower reaches of the Noosa River, Queensland, and the other from the Barrow River, Kuranda, North Queensland. The vertebrae were 19+19 in one specimen, whereas Ogilby recorded 21+20.

Some of the species in the Australian region centering around *Taeniomembras*, *Craterocephalus*, and *Stenatherina* cannot be assigned to the correct genus until their types are examined. Undoubtedly new genera will be proposed, or possibly, as connecting and intermediate species are studied, some of these genera will be united.

Named *Stenatherina* in reference to an atherine fish with a narrow premaxillary process.

A reexamination of specimens collected by me in the Phoenix and Samoan Islands indicates that U. S. N. M. Nos. 115112 and 115113 are *Stenatherina temminckii* and not "*Atherina uisila*." [3]

### Genus ALEPIDOMUS Hubbs

*Alepidomus* HUBBS, Occ. Pap. Mus. Zool. Univ. Michigan, No. 488, p. 7, 1944 (genotype: *Atherina evermanni* Eigenmann).

The generic diagnosis was based on six specimens of *A. evermanni* from Cuba bearing U. S. N. M. numbers 55697, 1 cotype; 126667, 4 cotypes; and 102203.

Apparently this genus is monotypic and so far has been found only in the fresh waters of the Island of Cuba.

Prof. Luis René Rivas, Colegio de la Salle, Habana, Cuba, has kindly summarized for me some of the localities where *A. evermanni* occurs on the Island of Cuba: Laguna de Piedras, a turbid body of fresh water, southeastern part of Pinar del Río Province, southwest of Artemisa, about 12 km. from the sea. Its outlet is a very small stream called Río Crespo and flows into the sea. The second locality is the Río Negro of the Hatiguanico System, Ciénaga de Zapata, in Province of Matanzas, a large stream emptying into La Broa Bay. The third locality is Arroyo Blanco de Mabuya, northwestern part of Camagüey Province, a small clear stream.

### Genus ALLANETTA Whitley

FIGURES 2*d*, 3*f*

*Allanetta* WHITLEY, Proc. Linn. Soc. New South Wales, vol. 68, p. 135, 1943 (genotype: *Atherina mugiloides* McCulloch [Proc. Roy. Soc. Queensland, vol. 24, p. 47, fig. 1, from Cape York, 1912]=*Atherinichthys punctatus* de Vis 1885).

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[3] See U. S. Nat. Mus. Bull. 180, p. 78, 1943.

I have examined the types of *Atherina araea* Jordan and Gilbert, U. S. N. M. No. 34967; *Atherina harringtonensis*, U. S. N. M. No. 21945; and paratypes of *Atherina ovalaua* Herre, U. S. N. M. Nos. 117318–9, 142910, 142911 sent in exchange by the Chicago Natural History Museum and refer them to this genus.

Among the species from the Pacific and Indian Oceans, I refer the following to this genus on the basis of material examined in the National collections: *Atherina valenciennesii* Bleeker; *A. duodecimalis* Cuvier and Valenciennes; *A. bleekeri* Günther; *A. woodwardi* Jordan and Starks; *A. balabacensis* Seale; and *A. regina* Seale.

### HYPOATHERINA, new genus

FIGURE 3c

*Genotype.—Atherina uisila* Jordan and Seale.

This new genus is related to *Allanetta* but differs in having the anus behind the tips of the pelvics and usually under the base of the first dorsal fin. The gill rakers are long and slender, the mouth large, rear of maxillary reaching a vertical line through the front of the orbit; vertebral counts in three specimens indicate about 18 or 19+22 or 23 vertebrae. The ascending premaxillary processes are moderately long and broad based but do not reach to opposite front of orbits; rami of mandibles elevated; origin of first dorsal near middle of standard length. This new genus may be separated from all related genera by the characters given in my key.

*Hypoatherina* is closely related to *Stenatherina* and shares with it the possession of an elongate median preanal membranous bony plate, embedded in flesh in front of the pterygiophores.

To the new genus *Hypoatherina* I refer U. S. N. M. No. 49816, three paratypes of *Atherina tsurugae* Jordan and Starks; U. S. N. M. No. 51726 and No. 126300, numerous cotypes of *A. uisila* Jordan and Seale; *A. panatela* Jordan and Richardson; *A. gobio* Klunzinger; *A. lacunosa* Forster in Bloch and Schneider as restricted and defined by Ogilby (Mem. Queensland Mus., vol. 1, p. 40, pl. 12, fig. 2, 1912) and based on U. S. N. M. No. 132607 from Queensland.

### Genus PRANESUS Whitley

FIGURES 2e, 3e

*Pranesus* WHITLEY, Mem. Queensland Mus., vol. 10, pt. 1, p. 9, 1930 (genotype: *P. ogilbyi* Whitley, based on Ogilby's figure of *Atherina pinguis* (not of Lacepède) from Moreton Bay, Queensland, in Mem. Queensland Mus., vol. 1, p. 38, pl. 12, fig. 1, 1912).

*Thoracatherina* FOWLER, Proc. Acad. Nat. Sci. Philadelphia, vol. 93, p. 249, 1941 (genotype: *Atherina insularum* Jordan and Evermann).

Studies of paratypes of *A. insularum*, U. S. N. M. No. 126902, from Hawaiian Islands, and Zanzibar specimens of *A. pinguis* Lacepède

indicate that these species belong in this genus. I have examined several lots from the Hawaiian and Philippine Islands and one lot from off Mauritius.

*Atherina morrisi* Jordan and Starks, *A. lineatus* Günther, *A. endrachtensis* Quoy and Gaimard, and *A. vaigiensis* Quoy and Gaimard belong in this genus. There may be several others that should be referred here.

### Genus ATHERINOMORUS Fowler

FIGURE 3*d*

*Atherinomorus* FOWLER, Proc. Acad. Nat. Sci. Philadelphia, vol. 55, p. 730, 1903 (genotype: *Atherina laticeps* Poey=*Atherina stipes* Müller and Troschel).

The generic diagnosis was based on numerous specimens of *A. stipes* from the western North Atlantic, the collection containing so many lots that it is not practical to list the U. S. N. M. numbers here except for the types of *Atherina laticeps* Poey from Cuba, U. S. N. M. No. 4764, and *Atherina velieana* Goode and Bean, U. S. N. M. No. 23629.

## ATHERIONINAE, new subfamily

### Genus ATHERION Jordan and Starks

FIGURE 2*g*

*Atherion* JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 24, p. 203, 1901 (genotype: *Atherion elymus* Jordan and Starks, from Japan).

This aberrant genus of silversides is placed in a separate subfamily because *Atherion* appears to be intermediate between the Taeniomembrasinae and the Menidiinae.

*Atherion* combines the concave premaxillary, shagreenlike denticles on outer surface of premaxillary, broad-based and short ascending premaxillary process, and broadened end of premaxillary, with the body cavity ending bluntly in front of the anal origin and not entering the haemal arches.

The five paratypes of *A. elymus*, U. S. N. M. No. 49812, from Japan, were examined, as well as numerous other specimens of the same genus from Guam and Bikini Atoll. The paratypes are in a bad state of preservation, having been dried. Two other species are *A. maccullochi* Jordan and Hubbs and *Atherina villosa* Duncker and Mohr, referable to this genus.

## TROPIDOSTETHINAE, new subfamily

This subfamily contains, at the present time, three genera characterized by their greatly compressed bodies, with the head short and truncate posteriorly; the air bladder not extending into the haemal arches as in the Atherininae; the greatest depth of the body occurring near the rear of the head and then the body tapering to the least depth

at the caudal peduncle and compressed throughout, with the ventral edge of the belly of almost paper thinness; premaxillaries, although nonprotractile, not dilated posteriorly, thus suggesting relationships with the Taeniomembrasinae.

### Genus NOTOCHEIRUS Clark

*Notocheirus* Clark, Copeia, 1937, No. 2, p. 88 (genotype: *Notocheirus hubbsi* Clark).

This remarkable genus, based on two specimens from Valparaiso Harbor, Chile, is one of the most aberrant of the atherine fishes, related to *Tropidostethus rhothophilus* Ogilby from the Australian region and *Iso flos-maris* Jordan and Starks from Japan. I have examined the paratype of *N. hubbsi*, and the generic diagnosis is based largely on that specimen. Indeed I have gone to great trouble to make a count of the vertebrae, which number 14+26 on the paratype, kindly lent me for study by Dr. W. M. Chapman, curator of fishes, California Academy of Sciences.

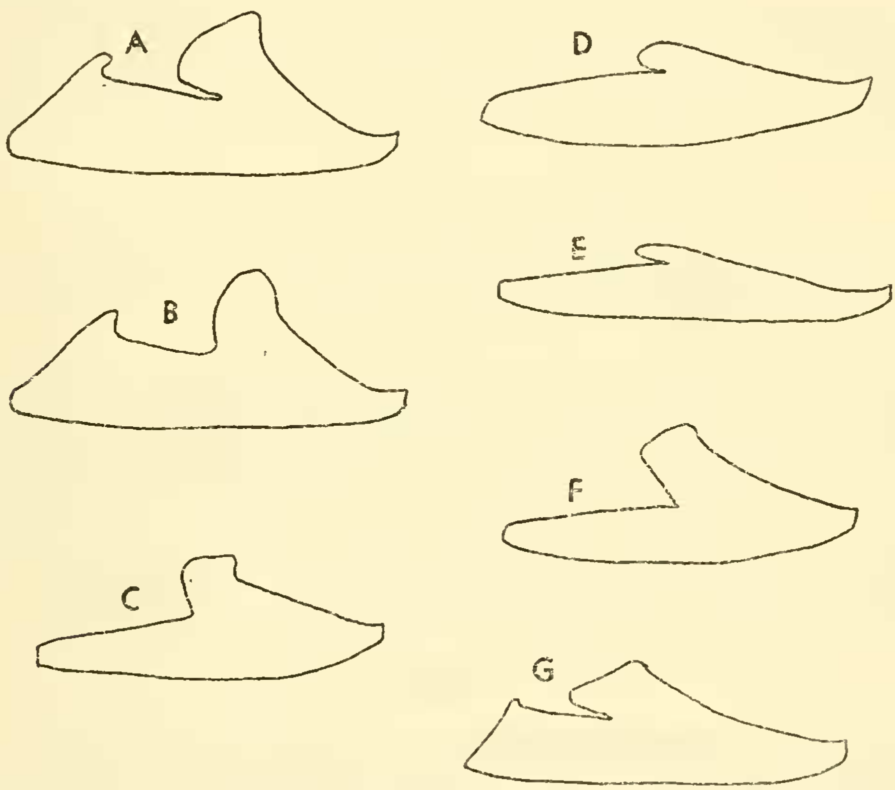


Figure 3.—Diagrammatic sketches of the mandibles of certain species of Atherinidae, dentition omitted: *A*, *Hepsetia rissoi* (Cuvier and Valenciennes), based on U.S.N.M. Nos. 10088 and 121859 from Europe, Bonaparte collection; *B*, *Stenatherina temminckii* (Bleeker), based on U.S.N.M. No. 136694 from the Philippines; *C*, *Hypoatherina uisila* (Jordan and Seale), based on U.S.N.M. Nos. 126300, paratypes from the Samoan Islands; *D*, *Atherinomorus stipes* (Müller and Troschel), based on U.S.N.M. No. 37098 from Cozumel Island; *E*, *Pranesus pinguis* (Lacepède) based on U.S.N.M. No. 136812 from the Philippines; *F*, *Allanetta area* (Jordan and Gilbert), based on U.S.N.M. No. 89597 from Cuba; *G*, *Hepsetia boyeri* (Risso), based on U.S.N.M. No. 48366 from Italy, Bonaparte collection.

### Genus TROPIDOSTETHUS Ogilby

*Tropidostethus* OGILBY, Proc. Linn. Soc. New South Wales, vol. 10, p. 332, 1895 (genotype: *Tropidostethus rhothophilus* Ogilby, from Maroubra Bay, Australia).

The generic diagnosis is based on three cotypes, U. S. N. M. No. 48830, from Maroubra Bay and on another lot of the genotype sent to the National Museum by Dr. Ogilby in 1894 and now bearing the number 45554. These latter specimens are in an excellent state of preservation and bore an unpublished manuscript name by Ogilby, which I have removed from the jar. It is highly probable that this is part of the collection used by Ogilby in describing *Tropidostethus rhothophilus.* One of the specimens had 14+28 vertebrae.

Dr. A. W. C. T. Herre (Proc. Biol. Soc. Washington, vol. 57, pp. 46–47, 1944) recently described as new *Iso flos-indicus* from India. On exchange Dr. Herre kindly sent four paratypes to the National Museum (No. 123651), one of which has 15+25 vertebrae. A study of these indicates that they belong to *Tropidostethus*, along with *rhothophilus* Ogilby and *natalensis* Regan. Dr. J. L. B. Smith (Rec. Albany Mus. South Africa, vol. 4, pt. 2, pp. 178–180, pl. 19, fig. c, 1935) gives a beautiful figure and good description of *natalensis* Regan, and without hesitation I refer it to this genus.

### Genus ISO Jordan and Starks

*Iso* JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 24, p. 204, fig. 4, 1901 (genotype. *Iso flos-maris* Jordan and Starks, from Japan).

The generic diagnosis is based on three paratypes of *I. flos-maris*, U. S. N. M. No. 49817. Since specimens of the three genera recognized under this subfamily are so scarce, I have made but a single vertebral count on the genotype of each genus. The three paratypes of *I. flos-maris* were in a poor state of preservation, having been partially dried at some time in the past. One of these has 18+26 vertebrae.

## MENIDIINAE, new subfamily

Now that the Atherinopsinae have been restricted to include those silversides with concave gape of mouth and with the air bladder tapering to a point posteriorly, and entering several modified haemal arches or terminating opposite modified vertebral hypophyses, there remains a group of genera more or less centering around *Menidia.* As here defined the new subfamily Menidiinae contains those silversides with concave gape of mouth; air bladder or body cavity ending abruptly, not extending into the haemal arches; and caudal vertebrae without modified haemal arches or broadened haemal hypophyses. The body cavity in certain genera does not quite reach to opposite the anal

origin, whereas in other genera it reaches a little past the anal origin.

Myers and Wade (Allan Hancock Pacific Exped., vol. 9, No. 5, p. 140, 1942) erected a new monotypic subfamily, Melanorhininae, for the Central American genus *Melanorhinus*, but the genus is an aberrant and highly specialized one, probably adapted for living in the surf.

In certain respects, such as the truncated head, air bladder ending bluntly, compressed body, and pectorals placed high on the body, *Melanorhinus* resembles the Tropidostethinae but differs from that subfamily in not having the premaxillaries expanded posteriorly, midventral line of abdomen without a thin paperlike fleshy keel, head without denticles, among other characters. The absence of a silvery lateral band in *Melanorhinus* probably is not of much value in guessing relationships. Since the air bladder ends bluntly and the hypophyses are unmodified on the anterior caudal vertebrae of *Melanorhinus*, this genus is referred to the subfamily Menidiinae, which likewise have unmodified vertebrae.

### Genus MELANORHINUS Metzelaar

*Melanorhinus* Metzelaar, Report on the fishes collected by Dr. J. Boeke in the Dutch West Indies 1904–05 . . ., p. 38, fig. 14, 1919 (genotype: *Melanorhinus boekei* Metzelaar).

*Mugilops* Meek and Hildebrand, The marine fishes of Panama, pt. 1, p. 271, pl. 22, fig. 1, 1923 (genotype: *Mugilops cyanellus* Meek and Hildebrand).

Myers and Wade (Allan Hancock Pacific Exped., vol. 9, No. 5, pp. 139–141, 1942) were the first to point out that *Mugilops* is a synonym of *Melanorhinus*. *Mugilops marinus* Meek and Hildebrand of the Atlantic is undoubtedly a synonym of *M. boekei* Metzelaar, as indicated by Myers and Wade. The Pacific representative of this genus is *M. cyanellus* Meek and Hildebrand.

The generic diagnosis was based on the holotypes of both *Mugilops cyanellus*, U. S. N. M. No. 81748, and on *Mugilops marinus*, U. S. N. M. No. 81742; on two paratypes of *M. cyanellus*, U. S. N. M. Nos 79720 and 79721; four specimens from Panama Bay, U. S. N. M. No. 128570, and on U. S. N. M. No. 9432.

Carl L. Hubbs and Luis R. Rivas have redescribed *Melanorhinus microps* (Poey) in a paper entitled "Systematics of an American Atherine Fish, *Melanorhinus microps* (Poey)," Journ. Washington Acad. Sci., vol. 36, No. 11, pp. 393–396, 1946. This publication was based on U. S. N. M. No. 9432, 28 specimens from Cuba.

### Genus ARCHOMENIDIA Jordan and Hubbs

*Archomenidia* Jordan and Hubbs, A monographic review of the family of Atherinidae or silversides, p. 54, 1919 (genotype: *Atherinichthys sallei* Regan).

The generic diagnosis given in the key was based on three specimens

of *A. sallei* reported upon by Jordan and Hubbs, from Río Hueyopam, San Juan, Acayucan, Mexico. These three specimens, now comprising U. S. N. M. No. 123208, were kindly sent to me from the original lot by Dr. R. M. Bailey, University of Michigan.

### Genus XENATHERINA Regan

*Xenatherina* REGAN, Biologia Centrali-Americana, Pisces, p. 64, 1907 (genotype: *Menidia lisa* Meek).

The generic diagnosis given in the key is based on 10 paratypes, U. S. N. M. Nos. 55851 and 82178, of *Menidia lisa* Meek from Refugio, Veracruz, Mexico.

### Genus LABIDESTHES Cope

FIGURE 4*b*

*Labidesthes* COPE, Proc. Amer. Philos. Soc., vol. 11, p. 455, 1870 (gentotype: *Chirostoma sicculum* Cope).

The generic diagnosis is based on very numerous specimens of *L. sicculus* Cope, in so many lots from Eastern North America that it is not practical to list the U. S. N. M. numbers here. In addition, the type and paratypes of *L. vanhyningi* were examined, U. S. N. M. Nos. 88485 and 88486, respectively.

### Genus ATHERINELLA Steindachner

*Atherinella* STEINDACHNER, Sitz. Akad. Wiss. Wien, vol. 71, p. 477 (p. 35 in reprint, Ichth. Beiträge No. 2), 1875 (genotype: *Atherinella panamensis* Steindachner).

The generic diagnosis given in the key was taken from Steindachner's description supplemented by that of Gilbert and Starks (Mem. California Acad. Sci., vol. 4, p. 59, pl. 9, fig. 17, 1904). Only the genotype is known. I have not seen a specimen of *A. panamensis.*

### Genus THYRINOPS Hubbs

*Thyrinops* HUBBS, Proc. Acad. Nat. Sci. Philadelphia, vol. 69, p. 306, 1918 (genotype: *Atherinichthys pachylepis* Günther).

*Thyrina* JORDAN and CULVER, *in* Jordan, Proc. California Acad. Sci., ser. 2, vol. 5, p. 419, 1895 (genotype: *Thyrina evermanni* Jordan and Culver) (preoccupied).

The generic diagnosis given in the key was based on numerous lots of *T. pachylepis* Günther, from the Pacific side of Central America. These lots are too numerous to list the National Museum catalog numbers. In addition, I have examined the holotype and paratypes of the following species and refer them to this genus:

*Thyrina guija* Hildebrand, holotype, U. S. N. M. No. 87273, and paratypes, U. S. N. M. Nos. 87274–87277.

*Menidia chagresi* Meek and Hildebrand, types, U. S. N. M. Nos. 79726 and 79728, and lectotype, U. S. N. M. No. 81761.

*Thyrina meeki* Miller, paratypes, U. S. N. M. Nos. 73935, 73954–73956, 73965.
*Kirtlandia beani* Meek and Hildebrand, holotype, U. S. N. M. No. 79741, and paratypes, U. S. N. M. No. 79740.
*Thyrina evermanni* Jordan and Culver, a paratype, U. S. N. M. No. 47494.
*Thyrina crystallina* Jordan and Culver, 3 paratypes, U. S. N. M. No. 47440.
*Melaniris sardina* Meek, 15 paratypes, U. S. N. M. No. 133087, were sent on exchange by the Chicago Natural History Museum.

Seven specimens of *Thyrinops colombiensis* (Hubbs), U. S. N. M. Nos. 79240, 120135, and 120223, from Colombia, Pacific side, are referred to this genus.

I have examined a large series of specimens of *Atherinichthys guatemalensis* Günther from near the type locality in Guatemala collected by Dr. R. R. Miller, and that species belongs in this genus. One specimen had 18+19 vertebrae.

I have before me the specimen, U. S. N. M. No. 116395, from Old Harbor, Jamaica, taken along with *Agonostomus monticola*, and possibly from fresh water that is closely related to *chagresi* but is less slender. I hesitate to describe it as a new subspecies since the specimen is not in a good state of preservation and relationships are too close for description and naming without a larger series.

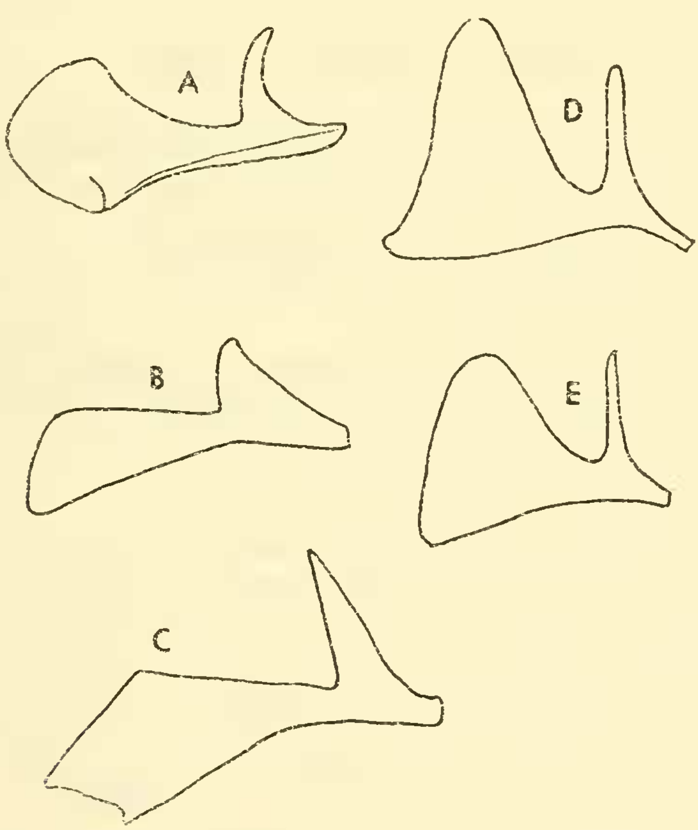


FIGURE 4.—Diagrammatic sketches of the premaxillaries of certain species of Atherinidae, dentition omitted: *A*, *Austromenidia regia* (Humboldt), based on U.S.N.M. No. 77293 from Lota, Chile; *B*, *Labidesthes sicculus* (Cope), based on U.S.N.M. No. 108574 from Alabama; *C*, *Xenomelaniris brasiliensis* (Quoy and Gaimard), based on U.S.N.M. No. 100901 from Brazil; *D*, *Leuresthes tenuis* (Ayers), based on U.S.N.M. No. 59473 from California; *E*, *Adenops analis*, new species, based on U.S.N.M. No. 121823, paratypes from Venezuela.

The following vertebral counts were made: *T. guija*, one count of 20+21; *T. pachylepis*, one count 20+21; *T. chagresi*, two counts 19+20 and 19+21; *T. meeki*, one count 20+20; *T. crystallina*, one count 18+21; *T. colombiensis*, one count 20+19.

### Genus MELANIRIS Meek

*Melaniris* Meek, Publ. Field Columbian Mus., zool. ser., vol. 3, No. 6, p. 117, 1902 (genotype: *Melaniris balsanus* Meek).

The diagnosis of this genus was based on 10 paratypes of *Melaniris balsanus*, U. S. N. M. No. 55793, from Río Balsas, Balsas, Mexico. I remove this species from *Thyrina* as recognized by Jordan and Hubbs in their 1919 review on the basis of the lower jaws being equal to or a little longer than upper, instead of shorter as in *Thyrinops*, and on the few number of abdominal vertebrae—15 or 16 instead of 18 to 20. The ascending premaxillary process of *Melaniris* is broad-based and triangular in shape whereas in *Thyrinops* it is narrower based, longer, and slenderer, and I find no glandlike structures on top of snout as in *Thyrinops.* The abdominal cavity extends to opposite the base of the second branched anal ray of *Melaniris* and notably farther posteriorly in *Thyrinops.*

### Genus CHIROSTOMA Swainson

*Chirostoma* Swainson, The natural history and classification of fishes, amphibians and reptiles, or monocardian animals, vol. 2, p. 243, fig. 67, 1839 (genotype: *Atherina humboldtiana* Cuvier and Valenciennes).

*Atherinoides* Bleeker, Verh. Batav. Gen. (Japan), vol. 25, p. 40, 1853 (genotype: *Atherina humboldtiana* Cuvier and Valenciennes).

*Atheronichthys* Bleeker, *ibid.*, p. 41, 1853 (genotype: *Atherina vomerina* Cuvier and Valenciennes=*C. humboldtiana*).

*Heterognathus* Girard, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 198, 1854 (genotype: *Atherina humboldtiana* Cuvier and Valenciennes).

*Lethostole* Jordan and Evermann, U. S. Nat. Mus. Bull. 47, pt. 1, p. 792, 1896 (genotype: *Chirostoma estor* Jordan).

*Elopsarum* Jordan and Evermann, Rept. U. S. Fish Comm. for 1895, p. 330, 1896 (genotype: *Chirostoma jordani* Woolman).

*Atherinichthys* Bleeker, *in* Jordan, Genera of fishes, pt. 2, p. 253, 1919 (emended spelling).

*Charalia* De Buen, Ann. Inst. Biol. Mex., vol. 16, No. 2, p. 505, 1945 (genotype: *Chirostoma bartoni* Jordan and Evermann).

*Palmichthys* De Buen, *ibid.*, p. 527 (genotype: *Chirostoma diazi* Jordan and Snyder).

*Acotlanichthys* De Buen, *ibid.*, p. 526 (genotype: *Chirostoma sphyraena* Boulenger).

*Otalia* De Buen, *ibid.*, p. 528 (genotype: *Chirostoma promelas* Jordan and Snyder).

Jordan and Hubbs (1919) and Jordan (*l. c.*, 1919) have interchanged the genotypes for Bleeker's genera *Atherinoides* and *Atheronichthys*, but I have corrected this in the synonymy above.

The genus *Chirostoma* appears to be related to *Menidia*, and such species as *Chirostoma jordani* are difficult to separate from *Menidia*, generically.

The generic diagnosis in the key is based on a large number of specimens of *Chirostoma humboldtiana* and numerous other species referable to *Chirostoma* from Mexico.

The following types and paratypes of the species listed below have been examined:

*Chirostoma attenuatum* Meek, paratypes, U. S. N. M. No. 55782.
*Chirostama promelas* Jordan and Snyder, paratype, U. S. N. M. No. 61274.
*Chirostoma zirahuen* Meek, paratype, U. S. N. M. No. 55780.
*Chirostoma jordani* Woolman, type, U. S. N. M. No. 45572, paratypes, U. S. N. M. Nos. 37830, 47509, 125441.
*Chirostoma bartoni* Jordan and Evermann, type, U. S. N. M. No. 23136.
*Chirostoma estor* Jordan, type, U. S. N. M. No. 23124.

Dr. F. De Buen (Ann. Inst. Biol. Mex., vol. 16, No. 2, pp. 499–530, 1945) has recognized certain genera and subgenera in his recent studies of Mexican silversides. He has given full generic rank to *Elopsarum*, with the following subgenera: *Elopsarum* Jordan and Evermann, including *E. arge* Jordan and Snyder, *E. labarcae* (Meek), *E. jordani jordani* (Woolman), and *E. j. mezquital* (Meek); *Charalia* De Buen, including *E. regani* (Jordan and Hubbs), *E. bartoni charari* De Buen, *E. bartoni bartoni* (Jordan and Evermann), and *E. bartoni zirahuen* (Meek). Under the genus *Chirostoma* Swainson, De Buen (p. 510) recognizes the following subgenera: *Palmichthys* De Buen, including only the genotype, *Chirostoma diazi* Jordan and Snyder; *Ocotlanichthys* De Buen, including only *Chirostoma sphyraena* Boulenger, the genotype.

*Lethostole* Jordan and Evermann has the following species or subspecies referred to it by De Buen (1945, pp. 521–522): *Chirostoma estor estor* Jordan, *C. estor pacanda* De Buen, and *C. estor copandaro* De Buen.

*Chirostoma* Swainson has the following species referred to this subgenus by De Buen (1945, pp. 511–512): *Chirostoma humboldtianum* (Cuvier and Valenciennes), *C. chapalae* Jordan and Snyder, *C. compressum* De Buen, *C. grandocule* (Steindachner), *C. consocium* Jordan and Hubbs, *C. ocotlanae* Jordan and Snyder, and *C. lucius* Boulenger.

De Buen recognizes as a full genus *Otalia* De Buen, referring but one species, *Chirostoma promelas* Jordan and Snyder, the genotype, to it.

Since the morphological characters of these genera and subgenera overlap considerably, I am inclined to recognize but one genus, *Chirostoma*, and would prefer, at present, to consider those proposed by De Buen at most of no higher rank than subgenera. Since no full com-

parison was made between the various generic units proposed by De Buen, the relationships of these forms are not clear.

### Genus MENIDIA Bonaparte

*Menidia* Bonaparte, Iconografia della fauna italica . . ., vol. 3, Pesci, named in description of *Atherina hepsetus*, fasc. 91, 1836 (no type listed, but *Atherina menidia* Linnaeus intended; also genotype fixed by tautonomy).
*Argyrea* DeKay, Zoology of New York, or the New York fauna, pt. 3, p. 141, 1842 (genotype: *Atherina notata* Mitchill) (preoccupied).
*Ischnomembras* Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 55, p. 730, 1903 (genotype: *Ischnomembras gabunensis* Fowler) (said to be from Gabun River, Africa, but according to Jordan and Hubbs locality is in error).
*Phoxargyrea* Fowler, *ibid.*, p. 732, 1903 (genotype: *Phoxargyrea dayi* Fowler) (said to be from India, but according to Jordan and Hubbs this is in error).

I have examined specimens of *Menidia menidia* (Linnaeus) from Charleston, S. C., the type locality of the genotype, as well as numerous specimens from the Atlantic coast in the National collections, the lots too numerous to make it practical to list the catalog numbers. Also I have examined numerous lots of *Menidia beryllina* and *M. peninsulae.* The latter species appears to have fewer caudal vertebrae; in 10 counts I found a range of 17 to 19+19 to 22, whereas in *M. menidia* in 4 counts the range was 17 to 19+24 to 27 vertebrae. No doubt the number of caudal vertebrae in the species of *Menidia* would overlap if numerous additional counts were made throughout the range of these species.

I have examined the types and paratypes of the species listed below and refer them to this genus. *Menidia beryllina cerea* Kendall, type, U. S. N. M. No. 50011, and paratypes, U. S. N. M. No. 125548. *Menidia peninsulae atrimentis* Kendall, type, U. S. N. M. No. 50010, and paratypes, U. S. N. M. Nos. 18070, 50459, 50467, 126783. *Menidia audens* Hay, types, U. S. N. M. Nos. 32206, 32303, 32307, 32308. *Chirostoma peninsulae* Goode and Bean, types, U. S. N. M. No. 21481. *Menidia dentex* Goode and Bean, types, U. S. N. M. No. 18051. *Menidia extensa* Hubbs and Raney, paratypes, U. S. N. M. No. 106716.

Two other specimens of *Menidia extensa*, U. S. N. M. No. 123800 from Lake Waccamaw, N. C., were studied. One has 21+22 vertebrae, anal rays II, 18 and II, 19, scales 43, and scales before dorsal 19.

### Genus POBLANA de Buen

*Poblana* De Buen, Ann. Inst. Biol. Mex., vol. 16, No. 2, p. 495, 1945 (genotype: *Poblana alchichica* De Buen).

The characterization of this genus is based on two paratypes, U. S. N. M. No. 123671, kindly sent to me on exchange from the University of Michigan Museum by Dr. R. M. Bailey. One of these has 16+22 vertebrae.

*Poblana* appears to be closely related to *Menidia* on the basis of the extension of the body cavity backward to over first few rays of anal fin, and the elongate, spinelike ascending process on the premaxillary among other characters.

The absence of scales anteriorly on the head and body may not be of much importance in determining relationships since the condition occurs in four other phyletic lines in the family Atherinidae: *Xenatherina*, *Alepidomus*, *Tropidostethus*, and *Iso*. In the first the ascending premaxillary processes are broad-based triangular plates. The last three genera are in other subfamilies.

### MENIDIELLA, new genus

*Genotype.—Menidia colei* Hubbs, Carnegie Inst. Washington Publ. No. 457, p. 248, pl. 10, fig. 1, 1936.

This new genus is related to *Menidia* but differs in being shorter and deeper bodied, with about 14+18 vertebrae instead of about 18 or 19+19 to 26 as in *Menidia*. In addition, the base of the anal fin is shorter, and there are fewer anal fin rays than in *Menidia*. *M. beryllina* approaches in shape of body that of *Menidiella*, closest of the species referred to the genus *Menidia*, but the air bladder or body cavity of *M. beryllina* extends notably past the anal-fin origin, whereas in *Menidiella colei* the body cavity reaches just to the anal-fin origin.

This new genus may be separated from all other related genera of Atherinidae by the characters given in my key.

For the generic description three paratypes of *Menidia colei* Hubbs, U. S. N. M. No. 117556, and the holotype of *Menidia conchorum* Hildebrand and Ginsburg, U. S. N. M. No. 87535, were used.

### XENOMELANIRIS, new genus

Figures 4c, 5b

*Genotype.—Atherina brasiliensis* Quoy and Gaimard.

The generic diagnosis of this new genus given in my key was based on the following specimens of *X. brasiliensis* in the collections of the United States National Museum: From Brazil, Nos. 83149, 100874, 100901, and 104220, totaling 11 specimens; from Trinidad, No. 5794, one specimen; from Venezuela, Nos. 121821, 121822, and 123204, totaling 13 specimens.

In addition to the genotype, *Menidia venezuelae* Eigenmann belongs to this genus. I have examined five specimens, 25.5 to 33.5 mm., from Lago de Valencia collected by Dr. F. F. Bond and lent me for study and report by Dr. R. M. Bailey, University of Michigan.

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## ADENOPS, new genus

FIGURES 4e, 5d

*Genotype.*—*Adenops analis*, new species.

This new genus has the premaxillary dilated posteriorly; premaxillary or gape of mouth a little concave at side; rictus restricted by a membrane folding between jaws; dentigerous surface of premaxillaries not reflected outward and covering face of that bone with "shagreen"; two dorsal fins present; silvery lateral band present; mouth small, the maxillary not reaching to eye; air bladder and body cavity not reaching anywhere near to opposite anal fin origin; first dorsal origin notably in front of anal origin; pelvic insertions equidistant or closer to opercular margins or upper angle of pectoral fin base than to anal origin; about five or six scales forming a sheath anteriorly along base of anal fin; margin of scales entire or crenulate; distal margins of dorsal and anal fins concave; ascending process of premaxillary a narrow-based elongate spinelike projection; vertebrae 14 to 16+22 to 26.

Other characters are those of the genotype. The genus differs from all other genera of the family except *Membras* and *Thyrinops* by having four shallow glandlike depressions on the dorsal surface of the snout. From *Membras* it differs in having the anus near the middle of the distance between anal origin and the pelvic bases, instead of a little in front of anal origin, and in having fewer abdominal vertebrae, 14 to 16 instead of 18 to 20. It may be separated from other Atherinidae by the characters given in the key. In *Thyrinops* the air bladder extends some distance past the anal-fin origin.

The only other American atherine fish with the posterior end of the premaxillary dilated that has the anus far forward is *Archomenidia sallei* (Regan), but in this genus the body cavity and air bladder extend conspicuously some distance past the anal-fin origin.

Named *Adenops* in reference to the four depressions on the dorsal surface of snout, which appear to be glandular.

### ADENOPS ANALIS, new species

FIGURE 6

*Holotype.*—U. S. N. M. No. 121824, a specimen 59 mm. in standard length, collected by Leonard P. Schultz at night by flashlight in Lago de Maracaibo, 1 km. off Pueblo Viejo, Venezuela, on April 7–8, 1942.

*Paratypes.*—U. S. N. M. No. 121823, 66 specimens, 9 to 53.5 mm. in standard length, taken along with the holotype and bearing same data. There appear to be at least two age groups in this lot, with 25 specimens 9 to 17.5 and 41 specimens 19.5 to 53.5 mm.

*Description.*—Detailed measurements were made on the holotype and two paratypes, and these data, expressed in hundredths of the standard length, are recorded in table 1.

Greatest depth of body about $5\frac{1}{2}$ to $5\frac{3}{4}$, head $4\frac{1}{2}$ to $4\frac{2}{3}$, both in standard length; snout $3\frac{1}{2}$ to $3\frac{3}{4}$, orbit $3\frac{1}{3}$ to $3\frac{1}{2}$, interorbital 3 to $3\frac{1}{3}$, all in length of head; premaxillary a little curved, causing gape of mouth to be somewhat concave; mouth rather small, the maxillary not reaching to front of orbit; gill rakers slender, the longest about two-thirds diameter of pupil; rear margin of pupil about in middle of length of head; pelvic fin insertions a little closer to upper angle of pectoral-fin base than to anal origin; anal origin equidistant between midbase of caudal fin and second third of length of opercle; first dorsal origin conspicuously a little in front of a line through anal origin; second dorsal origin about over base of sixth from last anal-fin rays; pelvic fins short, usually reaching a trifle over halfway to anal origin; the anus is located nearly equidistant between anal origin and pelvic bases, but much closer to pelvic bases in the smaller ones; the body cavity extends only a trifle past anal opening; the ascending premaxillary processes are long, slender, with narrow bases, not triangular in shape; pectoral fins pointed, reaching a short distance past pelvic bases; interorbital space a little convex; belly rounded; posterior margins of scales entire; silvery lateral band present, wider than pupil anteriorly, but constricted a little on caudal peduncle where it is not quite so wide as pupil; least depth of caudal peduncle $2\frac{1}{5}$ to

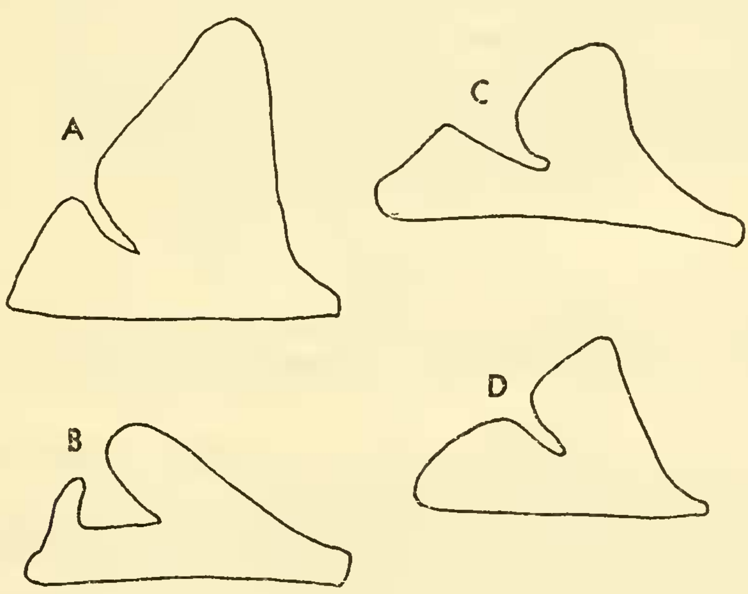


Figure 5.—Diagrammatic sketches of the mandibles of certain species of Atherinidae, dentition omitted: *A, Leuresthes tenuis* (Ayers), based on U.S.N.M. No. 54493 from California; *B, Xenomelaniris brasiliensis* (Quoy and Gaimard), based on U.S.N.M. No. 100901 from Brazil; *C, Austromenidia regia* (Humboldt), based on U.S.N.M. No. 77293 from Lota, Chile; *D, Adenops analis*, new species, based on U.S.N.M. No. 121823, paratypes from Venezuela.

$2\frac{2}{5}$ in its length; lower jaw a little shorter than upper, slightly included; teeth minute in both jaws in a narrow villiform band.

The following counts were made, respectively: Dorsal rays, IV–I, i, 8; V–I, i, 7; and IV–I, i, 7. Anal rays I, i, 14; I, i, 14; and I, i, 14. Pelvics always I, 5. Pectoral rays ——; i, 12–i, 12; and i, 12. Branched caudal rays 15; 15; 15. Scales above lateral line to first dorsal origin $3\frac{1}{2}$; $3\frac{1}{2}$; $3\frac{1}{2}$, and below lateral line to anal origin $2\frac{1}{2}$; $2\frac{1}{2}$; and $2\frac{1}{2}$. Scales in the lateral line 44; 44; 44. Scales in front of first dorsal to rear of pigmented area over brain, 20; 21; 20. Scales between anal origin and anus 4; 4; 4. Scales between dorsal bases of dorsal fins 7; 7; 6. Zigzag scales around least depth of caudal peduncle 12; 12; and 12. Gill rakers on first gill arch 4 + 1 + 14; ——; and 2 + 1 + 13. Additional counts will be found in table 1.

*Coloration.*—In alcohol, straw-colored with silvery lateral band, bordered above by a narrow dark streak, wider anteriorly; middorsal line with a prominent row of black pigment spots or cells; each scale of back above silvery lateral band with a black spot, some scales with two of these small pigment spots, thus making two rows of spots each side of middorsal line; tip of snout with black pigment; a few black pigment cells on sides of lower jaw and a few near its tip.

*Remarks.*—This new species differs from all other atherinids in having four glandlike depressions on the dorsal surface of the snout with the exception of species referred to *Thyrinops* and *Membras.* However, in the species of the latter genus the anus is only a short distance in front of the anal origin and the margins of the scales are usually strongly crenulate, whereas in the *Adenops analis* the anus is far forward and the margins of the scales are entire.

Named *analis* in reference to the position of the anus.

### ADENOPS ARGENTEUS, new species

FIGURE 7

*Holotype.*—U. S. N. M. No. 121848, a specimen, 42.5 mm. in standard length, taken by the *Albatross* at Sabanilla, Colombia, March 16–22, 1884.

*Paratype.*—U. S. N. M. No. 121849, a specimen, 41.7 mm. in standard length, bearing same data as the holotype.

*Description.*—Detailed measurements were made on the holotype and paratype, and these data are recorded in table 1.

Greatest depth about 5, head $4\frac{1}{2}$, both in standard length; snout $3\frac{1}{2}$, orbit $3\frac{1}{5}$, interorbital $2\frac{3}{4}$ to 3, all in length of head; premaxillary a little curved, the gape of mouth somewhat concave; mouth small. Maxillary not reaching anywhere near front of orbit; gill rakers slender, about two-thirds diameter of pupil; rear margin of pupil at middle of length of head; pelvic fin insertions equidistant between

anal origin and upper angle of pectoral-fin base; anal-fin origin equidistant between midbase of caudal fin and the second third of length of opercle; dorsal origin notably in front of anal origin, about at a point where a vertical line passes an equidistance between anal origin and anus; second dorsal origin about over base of sixth ray of anal fin; pelvic fin short, reaching just a trifle over halfway to anal origin; anus located just a trifle closer to anal origin than to pelvic bases just before tips of pelvic fins; body cavity extends only a little past anal opening but not to opposite anal-fin origin; the ascending premaxillary processes are long, slender, with narrow bases, not triangular in shape, and well separated at middorsal line; pectoral fins with tips broken off as are rays in most of the other fins; interorbital space a little convex, wide; belly rounded; posterior margins of scales crenulate; silvery lateral band present, wider than pupil anteriorly, but slightly constricted on caudal peduncle where it is about width of pupil; least depth of caudal peduncle about 2⅕ to 2½ in its length; lower jaw a little shorter than upper, slightly included; teeth minute in both jaws, in a narrow villiform band.

The following counts were made, respectively: Dorsal rays IV–I, i, 7 and IV–I, i, 7; anal rays I, i, 13 and I, i, 15; pectoral rays i, 10–i, 11 and i, 11–i, 11; pelvics always I, 5; branched caudal fin rays 15–15; scales above lateral line to first dorsal origin 3½ and 3½, and below

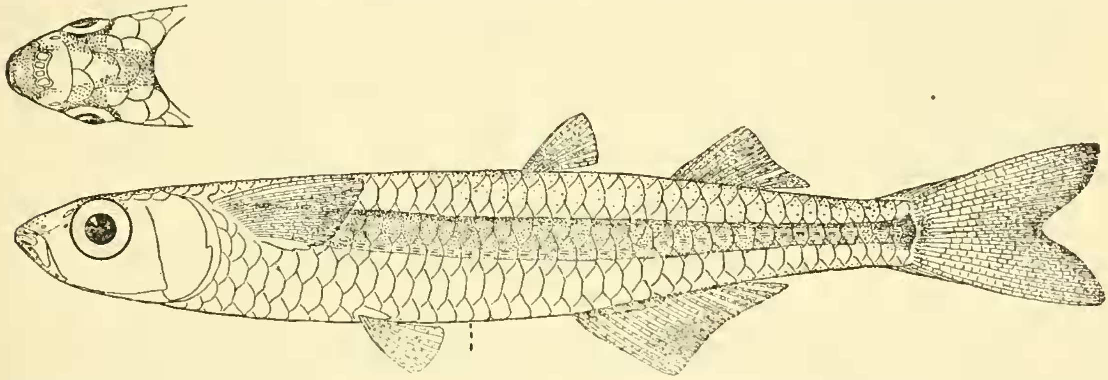

Figure 6.—*Adenops analis*, new species: Holotype, U.S.N.M. No. 121824. Standard length, 59 mm. Drawn by Mrs. Aime M. Awl.

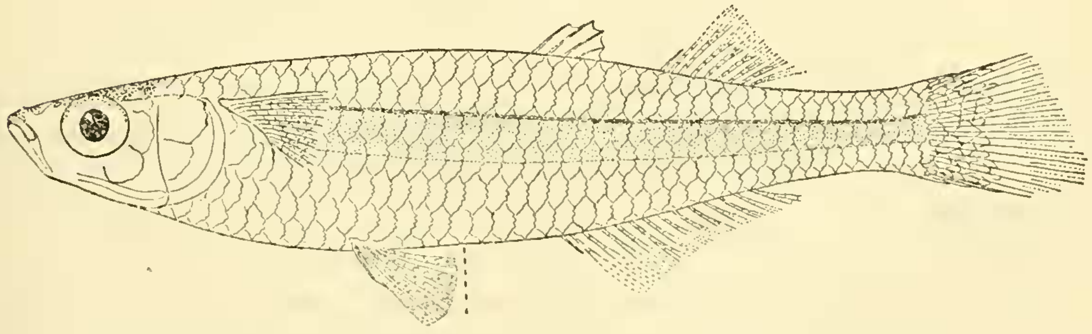

Figure 7.—*Adenops argenteus*, new species: Holotype, U.S.N.M. No. 121848. Standard length, 42.5 mm. Drawn by Mrs. Aime M. Awl.

lateral line to anal origin 2½ and 2½; scale rows from upper edge of gill opening to midbase of caudal fin 40 and 40; scales between anus and anal origin 4 or 5 and 5; scales in front of first dorsal 18 and 17; scale rows between dorsals 6 and 8; zig-zag scales around least depth of caudal peduncle 12 and ——; gill rakers on first gill arch 2+1+15 and 2+1+15.

TABLE 1.—*Measurements made on the two species of* Adenops, *expressed in hundredths of the standard length*

| Characters | *analis* | | | *argenteus* | |
|---|---|---|---|---|---|
| | Holotype | Paratype | Paratype | Holotype | Paratype |
| Standard length in millimeters | 59 | 45.5 | 34.8 | 42.5 | 41.7 |
| Length of head | 22.0 | 21.5 | 22.4 | 22.8 | 22.1 |
| Greatest depth of body | 15.9 | 18.2 | 17.2 | 21.2 | 19.9 |
| Length of snout | 7.29 | 6.16 | 6.90 | 7.06 | 6.95 |
| Diameter of orbit | 6.61 | 6.16 | 7.46 | 7.30 | 7.20 |
| Postorbital length of head | 10.0 | 9.67 | 9.48 | 9.40 | 9.35 |
| Width of bony interorbital space | 7.46 | 7.25 | 8.33 | 8.47 | 8.15 |
| Length of caudal peduncle | 20.3 | 21.1 | 22.4 | 23.5 | 19.7 |
| Least depth of caudal peduncle | 7.96 | 8.79 | 9.48 | 8.20 | 8.77 |
| Greatest width of head | 10.9 | 10.6 | 9.48 | 11.5 | 10.5 |
| Distance from: | | | | | |
| Pelvic insertion to anal origin | 22.7 | 22.6 | 22.4 | 22.3 | 24.0 |
| Snout tip to first dorsal origin | 57.6 | 56.9 | 56.6 | 57.0 | 55.6 |
| Snout tip to second dorsal origin | 73.6 | 72.0 | 73.0 | 73.0 | 73.1 |
| Snout tip to anal origin | 62.7 | 59.1 | 61.7 | 60.4 | 60.9 |
| Snout tip to pectoral insertion | 22.5 | 21.8 | 23.3 | 23.5 | 22.1 |
| Snout tip to pelvic insertion | 40.3 | 37.6 | 40.8 | 40.0 | 37.7 |
| First dorsal origin to second dorsal origin | 16.3 | 16.0 | 17.2 | 17.7 | 18.7 |
| Anal origin to center of anus | 9.66 | 10.5 | 10.6 | 8.70 | ---------- |
| Length of longest ray of: | | | | | |
| First dorsal fin | 8.64 | 6.59 | 7.18 | 6.59 | ---------- |
| Second dorsal fin | 9.15 | 10.3 | 10.3 | ---------- | ---------- |
| Anal fin | 12.2 | 11.6 | 12.4 | ---------- | ---------- |
| Pectoral fin | ---------- | 16.0 | 16.4 | ---------- | ---------- |
| Pelvic fin | 10.9 | 10.5 | 10.3 | 11.8 | 12.0 |
| Length of next to last ray of second dorsal | 4.58 | 4.62 | 4.31 | ---------- | ---------- |
| Length of last dorsal ray | 6.95 | 6.59 | 5.17 | 7.06 | 7.67 |
| Length of depressed second dorsal fin | 15.4 | 15.4 | 15.8 | 16.2 | 16.8 |
| Length of depressed anal fin | 25.1 | 24.4 | 24.1 | 25.4 | 25.0 |
| Length of base of second dorsal fin | 9.49 | 9.23 | 8.62 | 9.40 | 9.59 |
| Length of base of anal fin | 18.8 | 20.0 | 18.7 | 18.6 | 20.4 |

*Color in alcohol.*—In addition to the silvery lateral band, bordered by dark brown above, the dark pigment appears to have faded except along middorsal line and on upper surface of head where it occurs over the brain and around the four glandular areas on upper surface of snout.

*Remarks.*—This new species may be distinguished from the other member of the genus and from *Membras* by means of the following key:

1a. Vertebrae usually 14 to 16+24 to 26; anus in middle third of length between anal origin and pelvic bases or closer to pelvic bases than anal origin; anus at tips of pelvic fins or in front of them; origin of first dorsal notably in advance of a vertical line through anal origin; pelvic insertions about equidistant between anal origin and upper angle of pectoral fin base.

2a. Scales with margins entire; anus about equidistant between anal origin and pelvic bases or trifle closer to the latter; anal rays I, i, 12 to 14; scales 42 to 45 (Lago de Maracaibo, Venezuela).
Adenops analis, new species

2b. Scale margins strongly crenulate; anus a little closer to anal origin than pelvic bases; anal rays I, i, 13 and I, i, 15; scales 40 and 41 (Sabanilla, Colombia) ---------------------------- Adenops argenteus, new species

1b. Vertebrae usually 18 to 20+23 to 25; anus in front of anal origin, a distance about one-fourth the way to pelvic bases, notably behind tips of pelvic rays; origin or first dorsal approximately over anal-fin origin or a trifle in advance of it; scales crenulate or at least with some of them with rough margins; pelvic insertions closer to anal origin than upper angle of pectoral fin base; scales 42 to 50 -------------- Membras [4] Bonaparte

## Genus MEMBRAS Bonaparte

*Membras* Bonaparte, Iconografia della fauna italica . . ., vol. 3, Pesci, fasc. 91, 1836 (no type species mentioned but reference is made indirectly to Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 10, pp. 458, 459, 1835); Jordan and Hubbs, A monographic review of the family of Atherinidae or silversides, p. 56, 1919 (genotype: designated *Atherina martinica* Cuvier and Valenciennes).

*Kirtlandia* Jordan and Evermann, U. S. Nat. Mus. Bull. 47, pt. 1, p. 794, 1896 (genotype: *Chirostoma vagrans* Goode and Bean).

I concur in the opinion of Jordan and Hubbs that the generic name *Membras* Bonaparte is valid because there was a definite indication on the part of Bonaparte that he was taking the germ of his classification from that of Cuvier and Valenciennes. Since Cuvier and Valenciennes list a species (*Atherina martinica*) for one of the groups distinguished by them and since later a generic name (see p. 16) was assigned by Bonaparte, there remains no doubt about the validity of the genus *Membras* Bonaparte.

The nature of the species described by Cuvier and Valenciennes as *Atherina martinica* has never been exactly clear, even though Jordan once redescribed it. In an attempt to clear this matter up I wrote to Dr. L. Bertin, of the Muséum National d'Histoire Naturelle of Paris, and he examined the three types, furnishing the following information, for which I convey my sincere thanks to him:

The three types of *Atherina martinica* measure 68 (58), 99 (85), and 100 (86) mm. in length, with standard length given in parentheses. The body cavity does not extend quite to the anal-fin origin; ascending

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[4] The subspecies of this genus have not been clearly worked out, although *Membras martinica lacinata* is indicated by Jordan and Hubbs as ranging from New York to Florida and *Membras martinica vagrans* along the Gulf coast. If the form in the West Indies region is subspecifically distinct it should have the name *Membras martinica martinica*.

process of the premaxillary triangular; no sheath of scales along base of dorsal or of anal fins seen on the types, but these are easily lost in preservation, and since the majority of "*M. vagrans*" in the collections are lacking the scales, this character is of value only on perfectly preserved specimens; posterior margins of scales scalloped or entire; teeth in many rows on the premaxillaries and on the lower jaw; lower jaw largely included in upper when mouth is closed; first dorsal origin over anal origin; the former equal distance between caudal-fin base and rear of head; there are four glandular depressions, very clear, on the upper side of snout; dorsal rays 8, anal 19, pectoral 14, scales 45 and vertebrae 19+23=42.

The number of vertebrae in *M. martinica* 19+23, and the four glandular depressions indicate clearly that the types of *martinica* are the same species as has been currently passing under the names *Kirtlandia vagrans* or *Membras vagrans*. The only other known genus with which *Membras* could be confused is *Adenops*, but the number of vertebrae is 14 to 16+24 to 26 and the anus is farther forward in *Adenops*.

The generic diagnosis of *Membras* was based on the information furnished by Dr. Bertin; on the lectotype, U. S .N. M. No. 22848, and cotypes, U. S. N. M. No. 22864, of *Chirostoma vagrans* Goode and Bean (genotype of *Kirtlandia*); and on numerous other lots from the Atlantic and Gulf coasts of the United States, under so many catalog numbers that it is not practical to list them here.

I have not been able to locate the types of *Menidia vagrans lacinata* Swain but presume that *lacinata* is a synonym of *vagrans*, since I find in this genus only a single species, which forms subspecies [4] that intergrade throughout its range. The latter taxonomic units here have not been entirely clarified as yet.

### Genus EURYSTOLE Jordan

*Eurystole* Jordan, Proc. California Acad. Sci., ser. 2, vol. 5, p. 418, 1895 (genotype: *Atherinella eriarcha* Jordan and Gilbert).—Jordan and Evermann, U. S. Nat. Mus. Bull. 47, pt. 1, p. 802, 1896 (genotype: *Atherinella eriarcha* Jordan and Gilbert).

The generic description given in the key is based on the holotype of *Atherinella eriarcha* Jordan and Gilbert, U. S. N. M. No. 29243, from Mazatlán, and on five other specimens, U. S. N. M. Nos. 101634, 101635, and 119021. Myers and Wade (Allan Hancock Pac. Exped., vol. 9, No. 5, pp. 115–126, 1942) in their revision of *Eurystole* refer only one species, the genotype, to this genus.

### Genus NECTARGES Myers and Wade

*Nectarges* Myers and Wade, Allan Hancock Pac. Exped., vol. 9, No. 5, p. 126, pl. 19, 1942 (genotype: *Nectarges nepenthe* Myers and Wade).

*Euryarges* Myers and Wade, Allan Hancock Pac. Exped., vol. 9, No. 5, p. 128, pl. 18, 1942 (genotype: *Nectarges nesiotes* Myers and Wade).

The generic description is based on that of Myers and Wade and on the following specimens in the National Museum: A paratype of *Nectarges nepenthe*, U. S. N. M. No. 119020; the type of *N. nocturnus* Myers and Wade, U. S. N. M. No. 88712; one paratype of *nocturnus*, U. S. N. M. No. 88713, and 17 other specimens, U. S. N. M. Nos. 31011, 107147, 127866–7; also a specimen of *N. nesiotes* Myers and Wade, U. S. N. M. No. 101633.

Myers and Wade in their revision of the genus *Nectarges* (*l. c.*) list three species as follows: *N. nesiotes* from the Galápagos Islands; *N. nepenthe* from Baja California to Oaxaca; and *N. nocturnus* from Ecuador and Peru.

### Genus COLEOTROPIS Myers and Wade

*Coleotropis* Myers and Wade, Allan Hancock Pac. Exped., vol. 9, No. 5, p. 136, 1942 (genotype: *Menidia starksi* Meek and Hildebrand).

The generic diagnosis is based on the holotype *Menidia starksi* Meek and Hildebrand, U. S. N. M. No. 79732, and on four paratypes, U. S. N. M. Nos. 79733 and 81747, from Taboga Island, Panama Bay.

### Genus HUBBESIA Jordan

*Hubbesia* Jordan, Proc. U. S. Nat. Mus., vol. 55, p. 310, 1919 (genotype: *Menidia gilberti* Jordan and Bollman).

The generic description in the key was based on 10 types, U. S. N. M. No. 41165, and 8 paratypes, U. S. N. M. Nos. 41210 and 41480, all of *Menidia gilberti* Jordan and Bollman. In addition I have examined so many other lots in the national collections that it is not practical to list the catalog numbers here. They all were from the Pacific side of Panama in the Panama Bay region.

Also I have four specimens from the mouth of the Río Mulegé, Baja California, that appear to be *Hubbesia gilberti.*

## Subfamily ATHERINOPSINAE

This subfamily was set up by Fowler in 1904 and included *Atherinopsis*, *Protistius*, and *Gastropterus*, the last two names now being referred to the synonymy of *Basilichthys*. Jordan and Hubbs in their 1919 revision, not having investigated the nature of the air bladder in *Atherinopsis*, the type of the subfamily, included in their use of this name "all of the American species of the family, excepting a few of *Atherina* and *Hepsetia*." They go on to postulate about the ancestral type of this group, indicating that from "some *Menidia*-like form several distinct lines of evolution may be traced to aberrant genera." One must cast serious doubt on postulations on lines of evolution and closeness of relationship of genera when based largely, if not wholly, on external anatomy.

I am restricting the subfamily Atherinopsinae to that group of genera now known only from the Americas that have the premaxillary dilated or broadened posteriorly, its anterior edge concave, in combination with the air bladder tapering to a point posteriorly and extending opposite or into five or more of the broadened hypophyses of the haemal arches, these specialized hypophyses mostly interconnecting with one another by flattish, broadened, spinelike, bony processes opposite the tapering part of the air bladder. In certain genera such as *Atherinops*, *Atherinopsis*, and *Leuresthes* the haemal arches are small and the first one occurs six or more vertebrae in front of the first broadened hypophyses; thus the air bladder does not actually enter the haemal arch but enters a modified haemal arch farther posteriorly where the vertebral hypophyses are more or less broadened.

One cannot help but believe unless parallel evolution has occurred that these American Atherinopsinae with air bladder and specialized vertebrae are related to the European Atherininae and may have been derived from a common ancestral type. Indeed, it would be interesting to have specimens of the species of the African Atherinidae for examination in regard to these fundamental characters.

Thus restricted, all those other American genera with unmodified vertebrae and the air bladder ending abruptly and not extending into the haemal arches as described above must be referred to a new subfamily, the Menidiinae, erected for their reception.

### Genus AUSTROMENIDIA Hubbs

FIGURES 4*a*, 5*c*

*Austromenidia* HUBBS, Proc. Acad. Nat. Sci. Philadelphia, vol. 69, p. 307, 1918 (genotype: *Basilichthys regillus* Abbott=*Atherina regia* Humboldt).

*Atherinichthys* (*in part* but not of Bleeker) GÜNTHER, Catalogue of the fishes of British Museum, vol. 3, p. 402, 1861 (emended spelling).

*Basilichthys* of authors (not of Girard 1854) EVERMANN and RADCLIFFE, U. S. Nat. Mus. Bull. 95, p. 47, 1917.

*Menidia* EIGENMANN (not Bonaparte), Rep. Princeton Univ. Exped. Patagonia, vol. 3, p. 290, 1909.

*Cauque* EIGENMANN, Mem. Nat. Acad. Sci., vol. 22, Mem. 2, p. 56, 1927 (genotype: *Chirostoma maulcanum* Steindachner).

*Patagonina* EIGENMANN, Mem. Nat. Acad. Sci., vol. 22, Mem. 2, pp. 56, 60, 1927 (genotype: *Patagonia hatcheri* [Eigenmann]=*Menidia hatcheri* Eigenmann, 1909, from Lake Pueyrredon, Patagonia).

*Patagonia* EIGENMANN (*l. c.* in footnote, variation in spelling), same type (name preoccupied, however).

I have examined three specimens from Lake Llanquihue, the type locality of *Chirostoma mauleanum* Steindachner, labeled by Dr. Eigenmann as "*Cauque mauleanum* (Steind.)," now U. S. N. M. No. 84334, and I do not hesitate to place them in the genus *Austromenidia* Hubbs. One of these specimens had a vertebral count of 24+23 vertebrae. A

lot of *Menidia hatcheri* Eigenmann formerly part of Indiana University Museum No. 15301, now U. S. N. M. No. 121851, and from Laguna Fría, Lake Nahuel-Huapi, is referred to this genus. The generic diagnosis of this genus is based on numerous lots in the National collection including several species, among which are numerous specimens of *A. regia* (Humboldt), all from Peru, Chile, Argentina, including the Falkland Islands. A count made on *A. nigricans* from the Falkland Islands revealed 28+30 vertebrae.

The following species as recognized by Jordan and Hubbs are referred to this genus: *A. hatcheri* (Eigenmann); *A. regia* (Humboldt); *A. laticlavia* (Cuvier and Valenciennes); *A. gracilis* (Steindachner); *A. brevianalis* (Günther); *A. mauleanum* (Steindachner); *A. itatano* (Steindachner); *A. nigricans* (Richardson).

Upon writing to Dr. L. Bertin, Muséum National d'Histoire Naturelle, Paris, concerning the types of *Atherina jacksoniana* Quoy and Gaimard, I received the following information, which I greatly appreciate: There are four types measuring 62.5 (57), 71 (63), 73 (63), and 120.5 (105) mm., in total length, the standard length given in parentheses; origin of first dorsal fin equidistant between tip of snout and midbase of caudal fin; anus just in front of anal-fin origin; origin of first dorsal in front of anus; the latter about under rear base of this fin; body cavity not passing anal origin; ascending premaxillary process triangular; premaxillary protractile; no sheath of scales now present on bases of dorsal or anal fins; rays of first dorsal 7, second dorsal 12, anal 19, pectoral 13; vertebrae 28+31=59.

Gilbert P. Whitley (Proc. Linn. Soc. New South Wales, vol. 68, pp. 136–137, fig. 10, No. 2, 1943) redescribes and figures *Atherina jacksoniana* Quoy and Gaimard after examining the types at Paris. He states, "This species described from 'Port Jackson' by Quoy and Gaimard in 1825 has puzzled all later workers on Australian fishes because none of our Atherines has 18 anal rays or agrees in other particulars." Whitley states there are: Two rows of cheek scales; mandibular rami elevated; teeth distinct; gill rakers slender and numerous; scales 80; five rows of scales over lateral band; vent well behind tips of ventral fins and well before anal; pectorals with dusky tips; a broad silvery lateral band; about 12 or 13 dorsal and 18 anal rays. Both Whitley and Bertin agree that there are 12 or 13 rays in the second dorsal and 18 or 19 anal rays. Bertin in giving the vertebrae 28+31=59 conclusively casts this species out of most of the other genera of Atherinidae, except *Austromenidia*. In fact, none of the characters such as 80 scales, protractile premaxillaries, origin or insertion of all fins, position of anus, and especially the body cavity ending in front of the anal fin origin, given by Whitley or by Bertin disagree with that South American genus.

Tentatively, at least, I refer *Atherina jacksoniana* to the genus *Austromenidia*, but to know which species it must replace in that genus must await a revision of *Austromenidia* and further comparisons of the types of *A. jacksoniana*.

### Genus LEURESTHES Jordan and Gilbert

FIGURES 4*d*, 5*a*

*Leuresthes* JORDAN and GILBERT, Proc. U. S. Nat. Mus., vol. 3, p. 29, 1880 (genotype: *Atherinopsis tenuis* Ayres).

The generic description in the key is based on numerous specimens of the genotype from California.

I have examined the two types of *Leuresthes crameri* Jordan and Evermann, U. S. N. M. No. 47583, and they belong in this genus and undoubtedly are the same species as *L. tenuis*.

It would be interesting to know if the remarkable development of the air bladder in this genus has some connection to the close correlation of the tidal cycle with the highly specialized spawning habits of *L. tenuis*, so fully described by Dr. W. F. Thompson and others.

### Genus ODONTESTHES Evermann and Kendall

FIGURES 8, 9

*Odontesthes* EVERMANN and KENDALL, Proc. U. S. Nat. Mus., vol. 31, p. 94, fig. 3, 1906 (genotype: *Odontesthes perugiae* Evermann and Kendall).

*Kronia* RIBEIRO, Arch. Mus. Nac. Rio de Janeiro, vol. 17, Trematolepides, p. 9, 1915 (genotype: *Kronia iguapensis* Ribeiro).

*Pseudothyrina* RIBEIRO, Arch. Mus. Nac. Rio de Janeiro, vol. 17, Trematolepides, p. 11, 1915 (genotype: *Pseudothyrina iheringi* Ribeiro).

The generic diagnosis is based upon numerous specimens in the following lots in the National collections: The holotype of *Odontesthes perugiae*, U. S. N. M. No. 55572; U. S. N. M. No. 126660, another specimen of *perugiae;* and U. S. N. M. Nos. 1706, 55581, 77297, 84468, 122862, which probably are specimens of *bonariensis* or of a closely related species. Certain specimens of the last-named species have the dentition variable on the vomer, either present or absent, and I can find no good reason why *Kronia iguapensis* Ribeiro is not *bonariensis* or at least a closely related species, the status of which cannot be determined until the types of Ribeiro's species are reexamined. The dentition of the jaws in *O. perugiae* consists of two widely spaced rows of teeth, but in the material listed above and referred to *bonariensis* the teeth are variable, the two rows in some specimens as in *perugiae* but in others irregular, and even a third irregular row occurs between the two outer rows. The pikelike or pointed snout of *perugiae* is less pointed in *bonariensis*, even somewhat rounded in some specimens. Because of the overlapping of characters between the two kinds of

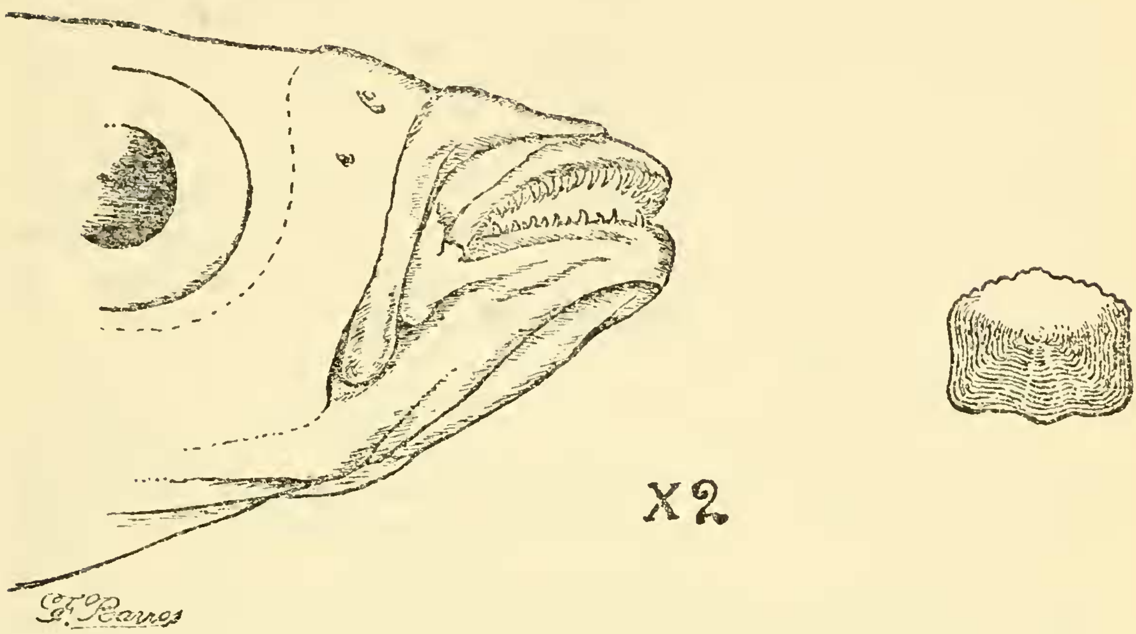


Figure 8.—A sketch by F. Barros of the head of the holotype of *Pseudothyrina iheringi*, furnished through the courtesy of Prof. Paulo M. Ribeiro.

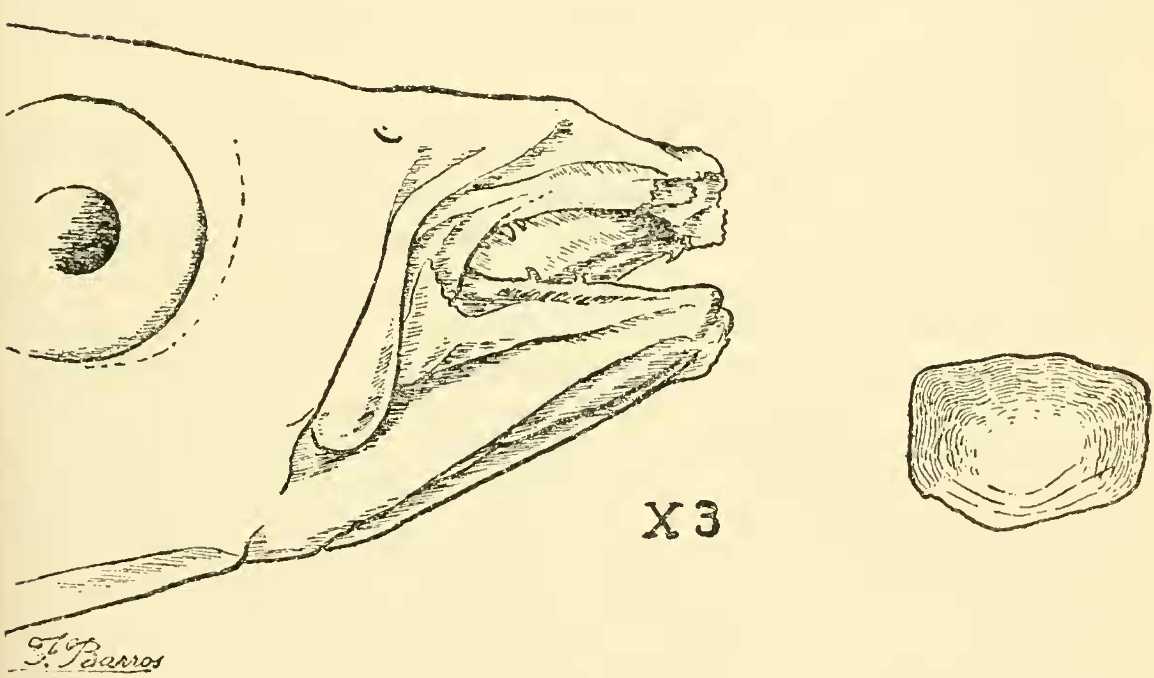


Figure 9.—A sketch by F. Barros of the head, with snout damaged, of the holotype of *Kronia iguapensis*, furnished through the courtesy of Prof. Paulo M. Ribeiro.

species, I have concluded that generically they should not be separated and that *Kronia* and *Pseudothyrina* belong in this group, and that they are not generically distinct from *Odontesthes.*

All counts given in the key were made on the specimens listed above and involved 10 counts for fin rays.

Both specimens of *O. perugiae* had IV-I, i, 7 dorsal rays, and I, i, 13 and I, i, 14 anal rays.

On May 1, 1945, I wrote to Prof. Paulo de Miranda Ribeiro, Museu Nacional, Rio de Janeiro, and in a letter dated June 25 I received from him the following information concerning the genotypes of *Pseudothyrina* and *Kronia* (figs. 8, 9), and for this data I express my sincere thanks to him:

The type, only known specimen, of *Pseudothyrina iheringi* Ribeiro has the body cavity extending into the haemal canal; the origin of first dorsal one and one-half series of scales in front of the origin of anal fin; origin of the second dorsal over eleventh ray of anal. "Teeth disposed irregularly, especially on lower jaw (mandible) giving the impression of bands, tending however to arrange themselves into two series (especially on the maxilla); they are conical, curved, and strong; the first series placed close to margin of jaw, there being between this series and the next a space that would serve for location of another series; I came across no vomerine teeth." The following counts were sent: "1st dorsal 4; 2d dorsal 9½; anal 18; pectoral 15; lateral line 53; vertical [scale row] under 1st ray of 2d dorsal, 9; under 1st ray of 1st dorsal, 11." The belly was compressed, and no sheath of scales was observed along the anal base.

I find no outstanding differences that separate *Pseudothyrina* from *Odontesthes* and therefore refer it to the synonymy of the latter genus.

The following was furnished from the type, only known specimen, of *Kronia iguapensis* Ribeiro: "The body cavity reaches half the distance between the anus (vent) and first anal ray, then narrowing and penetrating the haemal channel (canal)." He says that the first ray of the second dorsal fin is over the fourteenth anal ray; the distance from the first ray of first dorsal to first ray of second dorsal is contained four times in the distance from tip of snout to first dorsal origin; the first ray of first dorsal is over the anus. "The dentition is a good deal damaged, placing difficulties to a good understanding thereof; we can, however, say that it consists of relatively long teeth, conical and slightly curved inwards and tending to form two series, the exterior being implanted close to the [outer] border of the jaws and the second removed by a space that would permit the implantation of another series; all the teeth on the mandible are broken; those of the second [inner row] tending same way. Those on the vomer seem to have been placed in series, but I cannot be positive." Other notes indicate that what scales are left appear to have smooth

margins; although the tip of the snout is badly damaged, it overlaps the lower jaw. The belly is rounded, and there are a few scales forming a short sheath anteriorly along anal-fin base opposite no more than the first seven anal rays. The following counts I quote: "Anal 21 rays; pectoral 14; 2d dorsal 8½; 1st dorsal 5; an exact [scale] count impossible, many scales are missing; lateral line 60?; vertical [row] under 1st dorsal 11, and 9 under second."

Since I find no outstanding difference between *Kronia* and *Odontesthes*, the former becomes a synonym.

### Genus HUBBSIELIA Breder

*Hubbsiella* Breder, Bull. Bingham Oceanogr. Coll., vol. 2, art. 3, p. 6, figs. 2–4, 1936 (genotype: *Menidia clara* Evermann and Jenkins=*Atherina sardina* Jenkins and Evermann).

My generic diagnosis as given in the key was based on the holotype of *Menidia clara* Evermann and Jenkins, U. S. N. M. No. 43237, from the Bay of Guaymas, and on one other specimen, U. S. N. M. No. 123210, from the mouth of the Colorado River. In addition, I made an incision in the type of *Atherina sardina* Jenkins and Evermann, U. S. N. M. No. 39633, and found that the air bladder tapers to a point in the haemal canal, and that the hypophyses of the vertebrae are broadened the same as in *M. clara*. There are 54 scale rows along the sides of the body instead of 45, as given by Jenkins and Evermann. I conclude, therefore, that *M. clara* is a synonym of *A. sardina*, both coming from the same locality.

This genus is closely related to *Leuresthes*, the two being undoubtedly in the same phyletic line. It is not closely related to *Hubbesia gilberti*, this form having an entirely different air bladder, thus being in a different phyletic line, contrary to the opinion of Dr. C. L. Hubbs as expressed in Breder's description of the genus *Hubbsiella*.

### Genus BASILICHTHYS Girard

*Basilichthys* Girard, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 198, 1854 (genotype: *Atherina microlepidota* Jenyns).

*Protistius* Cope, Proc. Acad. Nat. Sci. Philadelphia, vol. 26, p. 66, 1874 (genotype: *Protistius semotilus* Cope) (ref. copied).

*Gastropterus* Cope, Proc. Amer. Philos. Soc., vol. 17, p. 700, 1878 (genotype: *Gastropterus archaeus* Cope).

*Pisciregia* Abbott, Proc. Acad. Nat. Sci. Philadelphia, vol. 51, p. 342, 1899 (genotype: *Pisciregia beardsleei* Abbott).

The generic diagnosis in the key was based on specimens of *B. microlepidotus* from Chile, as well as on other species. The specimens of this genus examined are U. S. N. M. Nos. 77355, 77356, 83646, 84327, and 84331.

*B. australis* Eigenmann belongs in this genus, along with *microlepidotus* Jenyns, *semotilus* Cope, *beardsleei* Abbott, and *archaeus* Cope.

### Genus ATHERINOPSIS Girard

*Atherinopsis* GIRARD, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 134, 1854 (genotype: *Atherinopsis californiensis* Girard).

My generic diagnosis is based on numerous specimens of *A. californiensis* from California as follows: types, U. S. N. M. Nos. 351 and 352; and the following nontype material: U. S. N. M. Nos. 354, 17015, and 24882.

I have examined the holotype of *Atherinopsis sonorae* Osburn and Nichols, U. S. N. M. No. 87544, and it belongs in this genus.

### Genus ATHERINOPS Steindachner

FIGURE 1*d*

*Atherinops* STEINDACHNER, Sitz. Akad. Wiss. Wien, vol. 72, p. 89 (p. 61 in reprint), 1875 (genotype: *Atherinopsis affinis* Ayres).

*Colpichthys* HUBBS, Proc. Acad. Nat. Sci. Philadelphia, vol. 69, p. 67, 1918 (genotype: *Atherinops regis* Jenkins and Evermann).

The generic diagnosis is based on numerous specimens of *A. affinis* from California: U. S. N. M. Nos. 15036, 17019, 17020, 26680, 54790, 73672, 83558, 121847, and 125271.

In addition, U. S. N. M. Nos. 67292, 119315, and 125329 are specimens of *A. regis* from the Gulf of California. The three types of *A. regis* Jenkins and Evermann, U. S. N. M. No. 39632, have been examined, and I fail to find any good reason why the genus *Colpichthys* was needed.

*Atherinops oregonia*, holotype U. S. N. M. No. 74762, has been examined and belongs in this genus, along with the following species or subspecies: *affinis*, *littoralis*, *magdalenae*, *insularum*, *cedroscensis*, and *guadalupae*.

## EXPLANATION OF PLATES

The plates are reproductions of part of the figures on plates 6 to 10 of Clementina Borsieri's paper in Annali di Agricoltura for 1902, No. 233, published in 1904, on the species of *Atherina* of Europe.

PLATE 1

1, *Atherina hepsetus* Linnaeus: *a*, Four of the haemal arches; *b*, premaxillaries and maxillaries; *c*, dorsal view of head.

2, *Hepsetia boyeri* (Risso): *a*, Premaxillaries and maxillaries; *b*, four of the haemal arches.

PLATE 2

1. *Atherina presbyter* Cuvier and Valenciennes: *a*, Five of the haemal arches; *b*, premaxillaries and maxillaries.

2, *Hepsetia mochon* (Cuvier and Valenciennes): *a*, Four of the haemal arches; *b*, premaxillaries and maxillaries.

3, *Hepsetia rissoi* (Cuvier and Valenciennes): *a*, Premaxillaries and maxillaries; *b*, four of the haemal arches.

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